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SLAC USERS BULLETIN NO. 102

NOVEMBER 1985 – APRIL 1986

Contents

Notices

Next NPAC Meeting — June 30, 1986

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SLAC's Scientific Policy Committee

The interests of SLAC's User community are represented by the SLAC Scientific Policy Committee, which meets several times a year to review SLAC's program and policies, its relationship with Users, and the like. Users and prospective Users of the SLAC facility are invited to address any problems or suggestions they may have to any of the members of the SPC. The present membership of the SPC is given below.

Term: 1986–1988

Alan Astbury	U. Victoria	John Peoples	FERMILAB
Charles Baltay	Columbia U.	Emilio Picasso	CERN
Charles Buchanan	UCLA	Lee Pondrom	U. Wisconsin
Ian Butterworth	CERN	Paul Reardon	BNL
Curtis Callan	Princeton U.	A. J. Stewart-Smith	Princeton U.
Helen Edwards	FERMILAB	Harold Ticho	UCSD
Normal Kroll	UCSD	George Trilling*	UCB-LBL
David Nygren	UCB-LBL	* Chairman	

SLAC's Experimental Program Advisory Committee

The experimental Program Advisory Committee (EPAC) consists of twelve members and advises the Director of SLAC in establishing the program commitments for the accelerator and experimental facilities. Meetings are scheduled as often as necessary, but no less than twice a year. All new proposals submitted to the EPAC two months before a given EPAC meeting will be considered at that meeting. Proposals for experiments at SLAC should be sent to the EPAC Secretary, David Fryberger, SLAC, Bin 20. For details of proposal preparation and submittal, please refer to the SLAC Users Handbook. Committee appointments are staggered and of three year duration. The current membership is shown below:

Wit Busza	MIT	Michael Peskin	SLAC
Jonathan Dorfan	SLAC	Joseph Polchinski	U. Texas
Friedrich Dydak	CERN	Abraham Seiden	UCSC
William Ford	U. Colorado	Michael Shaevitz	Columbia U.
Robert Jaffe	MIT	Melvyn Shochet	Fermi Inst.–U. Chicago
Harold Ogren	Indiana U.	Mark Strovink	UCB–LBL

Nuclear Program Advisory Committee

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Present Committee membership is as follows:

Erich Vogt, Chairman	TRIUMF	James McCarthy	U. Virginia
Joseph Cerny	LBL	William Turchinetz	MIT
Herbert DeStaebler	SLAC	J. D. Walecka	Stanford U.

SLAC USERS BULLETIN
(^{c}/o EFD – Bin 20)
Stanford Linear Accelerator Center*
Stanford University – Stanford, California – 94305
Editors: Lewis P. Keller – Dorothy Edminster

*Op[illegible] U.S. Department of Energy.

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*Operated by Stanford University under contract with the U.S. Department of Energy.

MASTER

1. EXPERIMENTAL ACTIVITY

A. General

The accelerator operated continuously November through February and then began a one month shutdown for SLC related work. During the four month cycle PEP delivered about 55 inverse picobarns to TPC, MAC, EHRS, ASP and MARK II. PEP will now be shutdown for approximately one year during which time another step in lowering beta will be taken in IR–2 (TPC) to try to get a factor of 3–5 luminosity increase using existing quadrupoles. This is the only IR out of six) which will be changed. During that time, TPC will install a new vertex detector. SPEAR delivered about eight universe picobarns at 2.07 GeV/beam to MARK III. SPEAR running for MARK III will also be stopped for about one year while SSRL is operated from the NPI gun and SLC is tuned up. During that time MARK III will also install a straw-type vertex chamber.

In End Station A, three experiments completed data taking: E–140 (X, Q^2 and Nuclear Dependence of $R = \sigma_L/\sigma_T$), NE–3 (Inclusive Electron Scattering from Nuclei), and NE–1/5 Electroproduction of the Delta Isobar in Nuclei). In March the NE–4 (Electron-Deuteron Scattering at Large Momentum Transfer at 180°) spectrometers were put back together and checkout for the NE–4 extension began in April using the NPI gun.

The test beam program was very active after the extremely difficult startup in November and December. (L. Keller)

B. Program Status and Reports of Experiments and Tests

Figure 1 is a research area plan showing the location of experiments and facilities. Figure 2 shows locations of the experimental beam lines in the research area. Figure 3 shows the long-range schedule. Table I is a list of presently approved high-energy experiments. The right-hand column of Table I gives the status and activity of each experiment during the cycle.

E–140 – *Measurement of the X, Q^2 and Nuclear Dependence of $R = \sigma(L)/\sigma(T)$ in Deep Inelastic Electron Scattering — American University, California Institute of Technology, Lawrence Livermore Laboratory, Stanford Linear Accelerator Center, Tel–Aviv University, University of Massachusetts, University of Rochester (A. Bodek, Univ. Rochester, and S. Rock, American Univ.)*

Experiment E–140 took data between mid–October 1985 and early January 1986. The purposes of the experiment are to test QCD predictions that R will become very small at large Q^2, and to look for nuclear effects suggested by previous measurements of the EMC effect.

The experiment was to run at energies between 3.5 and 21.0 GeV at a variety of beam currents from 1 mA to 40 mA and at an average repetition rate of 90 pps. The incoming beam position was measured at two separate positions and steered onto the target with typical accuracy of 10 μrad and less than 1 mm. The electrons were scattered from liquid hydrogen or deuterium, or from iron or gold foils. The 8 GeV spectrometer was used with a remodeled detector package designed to improve pion rejection. A new five-layer deep array of lead-glass counters was used successfully to separate electrons from pions between 1 and 8 GeV/c. This array has been used at momenta as low as 0.3 GeV/c. The Čerenkov counter was refurbished with a new high-gain, high-efficiency tube and newly coated mirrors. This enabled us to use atmospheric pressure hydrogen gas to combine

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99.7% efficiency with the lowest possible number of knock-on electrons from pions. The spectrometer magnets were controlled by the new 16–bit Power Supply Controller II developed for this experiment. They were reliable and stable to the 0.1% accuracy required.

The experimental equipment proved to be stable, reliable and robust in the face of a very unstable, unreliable and weak accelerator. Due to many problems with the accelerator, we never achieved satisfactory operation of the beam.

1) The beam spill, nominally 1.6 μsec long, was never more than 1.2 μsec and typically 1 μsec. We had to reduce our data taking rate under high-background conditions where instantaneous rates were a potential problem.

2) The maximum beam current available was never more than 15 mA with the full linac, and for much of the run was less than 7 mA. This limited our ability to take data at high Q^2 where the cross sections were low.

3) Our average repetition rate when the accelerator was on was close to 70 pps because of difficulties in filling the storage rings. This reduced our data taking rate.

4) The linac was off more than half the time (sometimes days on end).

Despite these difficulties, we were able to complete a reduced experimental program. We took data in the range $1 \leq Q^2 \leq 10$ $(\mathrm{GeV/c})^2$ on deuterium and over a reduced range on hydrogen, iron and gold. The A dependence was measured up to $Q^2 = 5$ $(\mathrm{GeV/c})^2$ in an x range between 0.2 and 0.5. Typical statistical errors on R will be about 0.03 at each of about 30 measurements.

Preliminary partial on-line analysis of the data indicate that the systematic errors are less than the statistical errors. The analysis is being worked on full-time by four graduate students, almost full-time by two post-doctoral students and part-time by two more senior people. It will be done on the overworked ESA VAX. Full radiative correction calculations will be carried out at Livermore. Preliminary results should be ready by the summer. (S. Rock)

SP–32 – MARK III *Detector at* SPEAR — *California Institute of Technology, Stanford Linear Accelerator Center, University of California at Santa Cruz, University of Illinois, University of Washington (D. Hitlin, CIT, and T. Schalk, UC Santa Cruz)*

Experiment SP–32 began running in mid–November 1985 and continued through the end of February 1986. Following three weeks of tune up of both SPEAR and the MARK III Detector, we began a thirteen-week run at a center-of-mass energy of 4.14 GeV. This energy is above the expected thresholds for $F\overline{F}$ and $F^*\overline{F}$ production, but below the expected threshold for $F^*\overline{F}^*$ production. We accumulated an integrated luminosity at 4.14 GeV of 5,500 inverse nanobars and an on-line estimate of 164,000 hadronic events. Just before the run started, the inner drift chamber (inside the main drift chamber) failed. In addition, we had a large amount of trouble with voltage breakdowns in our main drift chamber. Repairs to the main drift chamber are being started during the March shutdown and will be completed during the upcoming summer shutdown. The inner drift chamber will be replaced by our new vertex chamber during the summer shutdown. (D. Coward)

PEP–4/PEP–9 — *The Time Projection Chamber (TPC) Collaboration — Lawrence Berkeley Laboratory, University of California at Los Angeles, Yale University, University of California at Riverside, John Hopkins University, University of Tokyo, University of Bonn, University of California at Davis, Carnegie–Mellon, Nikhef, Aachen, (P. Oddone, LBL)*

The TPC/Two Photon Detector operated extremely well during the fall–winter data cycle, essentially being in data taking condition any time PEP was delivering luminosity. The integrated luminosity for the run was 40 inverse picobarns. In addition, a block of time was devoted to a test run for studying the feasibility of using PEP for electron–nucleus scattering. Three different gases, deuterium, argon and xenon, were tried in different runs in which gas injections were made into the TPC beam chamber.

The detector is now pulled out of the beam for the modifications associated with the addition of a high resolution vertex chamber. We expect the detector to be operational again in early 1987 for tests of the high luminosity upgrade of PEP. (P. Oddone)

PEP–6 – *Magnetic Calorimeter Detector to Study Electron/Positron Collisions (MAC) — University of Colorado, Frascati, University of Houston, Northeastern University, Stanford Linear Accelerator Center, Stanford University, University of Utah, University of Wisconsin (D. E. Groom, U. Utah)*

The MAC detector logged just under 40 inverse picobarns (after correction) during the 1985–86 fall and winter cycle. MAC data acquisition started with the PEP turn-on in 1980, and terminated with the PEP shutdown on 28 February 1986.

Lifetime measurements using the high-precision vertex chamber have been the main goals during the past two years. The 1984 fall cycle was used to debug the new system. Since that time, 95 inverse picobarns have been logged, rather short of repeatedly downgraded goals. A large off-line effort led to a single-wire resolution of 50 μm. The same survey techniques were applied to the central drift chamber, resulting in an improved resolution of 170 μm. A similar effort has gone into improving B–enriched sample selection and new B lifetime measurements are emerging from both the new data (about 50 e–tagged and 140 μ–tagged events) and a re-analysis of data taken before installation of the vertex chamber. Statistical errors reflect into ± 0.15 ps in the B lifetime.

During the cycle, MAC papers on precision measurements of $\tau^{\pm}$ branching ratios and the $\mu^+\mu^-$ asymmetry were published. In various states of completion are also papers on supersymmetric particle production limits, charge asymmetry in hadronic production, $\gamma\gamma$ and e^+e^- production, α_s determination from the shape of hadronic events, and a number of other topics in addition to the B lifetime determination.

The detector worked well throughout the cycle except for the loss of two central drift chamber wires, which resulted in the loss of less than 1 inverse picobarn of data. The PEP operations group provided outstanding support. Underlying much of MAC's success over the past five and one-half years has been the remarkable support of SLAC's computation group. The rest of the SLAC structure has also been extremely helpful in getting devices designed, built, installed, aligned, working and maintained. (D. E. Groom)

PEP–12 – *High Resolution Spectrometer — Argonne National Laboratory, Indiana University, Purdue University, University of Michigan, Lawrence Berkeley Laboratory (M. Derrick, ANL)*

Despite the erratic performance of the linac and some unusual scheduled downtime at PEP, we accumulated 44 inverse picobarns at 29 GeV during the period November 1985 through February 1986. When this is added to our previous years' total, we obtain 300 inverse picobarns for the entire life of the HRS.

Our data analysis effort has produced some interesting results. We submitted a paper on the first measurement of the F meson lifetime obtained in e^+e^- collisions. The number obtained is $3.5^{+2.4}_{-1.8} \pm .5 \times 10^{-13}$ sec.

We recently explored our entire data sample looking for enhancements in the $\pi\pi$ mass spectrum. We see a good $f(1270)$ signal and a small but significant $S^*(975)$ signal.

The study of multiparticle final states is also progressing. A paper was submitted on the dependence of the multiplicity on the rapidity in our data. The distributions of the multiplicity are wider for smaller rapidity spans than for larger ones. The distributions are well fit by a negative binomial expression. (D. Rust)

PEP–21 – *Search for Unseen States Using Photon Tagging — Stanford Linear Accelerator Center, Massachusetts Institute of Technology and University of Washington (D. Burke, SLAC)*

The ASP experiment completed taking data at PEP with the accumulation of 48 inverse picobarns during the Fall 1985/Winter 1986 running cycle. This brought the total luminosity for the experiment to 117 inverse picobarns, all at $\sqrt{s}$ = 29 GeV/c^2. The detector hardware was unchanged from its initial configuration, and the running went quite smoothly.

The efforts of the collaboration have focused on analysis of the data, and the result of the initial search for single photon events was published in Physical Review Letters in February 1986. No signal was observed in the first 69 inverse picobarn data sample. The standard weak production of three neutrino species is expected to have resulted in one observed event in this sample. The experiment placed a 90% C.L. limit of $N_\nu < 14$ on the possible number of light sequential neutrino species, and a limit of 51 GeV/c^2 on the mass of the scalar supersymmetric partner of the electron (with $m_{\tilde{\gamma}} = 0$). The sensitivity of the experiment will improve with the addition of this year's data and further development of the analysis.

Other analyses are getting underway. These include searches for single isolated electrons, and for low-multiplicity two- and four-prong events with missing momentum transverse to the beam line. The ASP detector is ideally suited for investigations of this type. Analyses of single and double tagged two-photon events are also being developed. Results from all of these research efforts should become available during the upcoming year. (D. Burke)

SLC–6 – *Mark II at the SLC — California Institute of Technology, University of Colorado, University of Hawaii, Indiana University, Johns Hopkins University, Lawrence Berkeley Laboratory, University of Michigan, Stanford Linear Accelerator Center, University of California at Santa Cruz (G. Feldman, SLAC)*

One of the main reasons for having an existing PEP detector, the MARK II, as the first SLC detector is to have a fully debugged apparatus ready to produce physics results as soon as the

SLC can deliver colliding beams. The run at PEP from November 1985 through February 1986 was an integral part of the procedure of preparing the MARK II for this role.

In preparation for the increased requirements for SLC–physics, the MARK II underwent a major upgrade during the past two years. The entire inner section of the detector was replaced with upgraded components, including a new central drift chamber, an inner trigger chamber, time-of-flight counters, and endcap calorimeters. The solenoidal coil was also replaced since the old coil had developed a short circuit.

The main functions of the 1985–86 cycle on PEP for the MARK II were to commission and test these components, to develop analysis programs for them, and to take a sufficient amount of PEP data to prepare and test SLC analysis programs. The cycle was quite successful for all of these goals. All of the new detector components worked at or beyond their expected performance levels. The new tracking algorithms worked well online, and the tracking resolution of the central drift chamber has already been shown to be 15% better than that specified in the MARK II SLC proposal. The new FASTBUS data acquisition system for the drift chamber functioned well throughout the run.

The MARK II collected 33 inverse picobarns of high quality data, which are now being processed. These data will allow a comparison of measurements made with the same detector at both PEP and SLC energies. (G. Feldman)

T–172 – *Particle Yields in Beam Line 6 with* NPI — *(R. Gearhart, SLAC)*

The secondary electron yield was measured for NPI energies of 4.5 and 3.0 GeV at secondary electron energies in the range 2–4.25 GeV and 1–2.875 GeV, respectively. The target used was 0.3 radiation length of beryllium. Upper limits on the pion flux were obtained. (E. B. Hughes)

T–349 – *SLD Calorimeter Tests — University of Washington, Massachusetts Institute of Technology, University of Wisconsin (J. Johnson, Univ. Wisconsin)*

Results from the tests conducted December 1984–May 1985 were reported in three papers presented at the IEEE Nuclear Science Symposium, San Francisco, California, October 23–25, 1985. These results were essential to the choice of radiator material for the SLD liquid argon calorimeter, with uranium being dropped in favor of lead at a substantial cost savings with little or no penalty in performance. It was also shown that the performance of the chosen design for the SLD iron calorimeter (to measure the energy escaping from the liquid argon section) was better than expected.

Additional data were collected in February 1986 to continue studies of the iron calorimeter. The uranium/lead/liquid argon test module was removed so that beam was directly incident on the iron module. As before, this consisted of seventeen 5 cm-thick plates interspersed with planes of plastic streamer tubes having external cathode pads and strips to read out the signals. To avoid electronic saturation effects observed previously, the gain of the charge amplifiers for the pad signals was reduced by a factor of five. To facilitate comparison of the energy measured from strip signals versus pads, integrating charge amplifiers were added to the strip readout. In addition, changes were made to the high voltage distribution system to reduce or eliminate previously observed cross talk effects between pads. Based on preliminary on-line analysis, each of these changes resulted in the desired improvements. (J. Johnson)

T–381 – *Test of Lead–Glass Counters — KEK (Kazuo Ogawa, KEK)*

Fundamental properties of lead-glass counters to be used in the VENUS detector at KEK were measured using incident positrons in Beam Line 19. Inasmuch as the counters are designed to be assembled in a semitower arrangement, the position and angle dependencies, as well as energy resolution, were measured at several energies up to 16 GeV. The best resolutions measured were for the central blocks of the array:

$$\frac{\sigma}{E} = 2.0\% \ + 6.9\%/\sqrt{E} \text{ for } 16X_0 \text{ counters}$$

$$\frac{\sigma}{E} = 1.0\% \ + 4.8\%/\sqrt{E} \text{ for } 18X_0 \text{ counters}$$

For counters to be used far from the central region, the blocks are more markedly tapered and the inherent energy resolution is degraded by approximately a factor of two. We also noted angle and position dependencies of several percent in pulse height, but corrections for shower sharing will limit the losses to 1–2%. (R. Gearhart)

T–385 – *Preparation for EGRET Calibration in Beam Line 27 — (J. Mattox, Stanford Univ.)*

In preparation for the calibration of the Energetic Gamma Ray Experiment Telescope (EGRET) at SLAC (April–June 1986), operation of the back-scattered laser beam was further explored over the range of electron energies (22 GeV–0.76 GeV) required to produce gamma rays from 10 GeV to 20 MeV. The quadrant detector collimator was successfully modified to collimate the gamma ray beam with either the old 3 mm aperture or a 1 cm aperture at lower energy. Beam monitoring capabilities of a 15 cm plastic scintillator, the quadrant detector and the laser power-beam current product were tested at several energies by comparison to a 20 inch thick NaI(Te) spectrometer. Operation of the YAG laser at 20 Hz was demonstrated. (J. Mattox)

T–386 – *Test of Small Drift Chambers — University of California at Davis (K. Sparks, UC Davis)*

We have tested three small (1 m × 1 m) drift chambers in test Beam Line 26 at SLAC. The object of this test was to try to understand the effects of misaligned field-shaping strips and sense wires on the efficiency and resolution of drift chambers. These chambers were originally installed as supplementary chambers in the PEP–9 experiment.

Stationary chambers were placed up and downstream of a third chamber. The middle chamber was on a movable trolley. The middle chamber had field-shaping copper strips on the lid displaced from those on the base by as much as 3 mm. The outer chambers were used to define tracks through the center chamber, a track being defined for our purposes as a hit in three out of four cells.

The beam was pions of energy 8 GeV/c. We took approximately 10,000 events. Data were logged using an LSI–11 provided by SLAC running the ATROPOS system. All events were written directly to tape for off-line analysis.

Our results indicate that the efficiency of these chambers drops rapidly with increasing distance from the sense wire. This dependence is useful to know, since we are trying to understand the disappointing efficiencies of other large drift chambers. Whether this drop in efficiency is directly related to the misaligned field-shaping strips or to other problems such as floating strips will require further tests.

We also tested the performance of a 30 cm $\times$ 80 cm delay-line prototype chamber. The prototype chamber was also placed in the middle position in the setup described above. We found a position resolution along the sense wire using the delay line readout of better than 300 microns, and feel confident in our abilities to achieve similar performance in large (2.4 m $\times$ 2.4 m) chambers planned for the H1 experiment at HERA. (K. Sparks)

T–389 – *Survey of NaI(T1) Crystal Module — (E. B. Hughes, HEPL)*

The Landau peak provided by 8 GeV pions was used to survey the response of a single NaI(T1) module of the dimensions ($2\frac{1}{2} \times 2\frac{1}{2} \times 20''$) used in the Crystal Box detector. Such modules are usually tested and optically adjusted with radioactive sources. The response of the test module throughout its volume was probed by pion trajectories parallel to the major axis and transverse to this axis. (E. B. Hughes)

T–390 – *A First Test of Internal Target Physics in the* PEP *Storage Ring — (K. Van Bibber, LLNL)*

With the end in view of a dedicated nuclear physics interaction region at the PEP storage ring, a pilot study of internal target physics was performed at IR–2, February 22-24. The specific purposes of the test were to: (i) demonstrate that gases (including noble gases) could be cycled in and out of the ring rapidly and without detriment to the vacuum environment; (ii) confirm that beam-gas luminosities on the order of 10^{31} would have no observable effect on storage lifetime or beam-beam luminosity and thus could be operated transparently to the rest of the high energy program; (iii) study rates and event topologies to assist in the design of a spectrometer system for internal target nuclear physics; and (iv) take some data to begin to investigate exclusive hadronic final states in deep-inelastic scattering for nuclear targets.

The TPC/2γ detector was ideal for this study due to its excellent particle identification, and low-angle spectrometer and calorimetry. An ultrahigh vacuum-standard gas system was designed and constructed at the Lawrence Livermore National Laboratory that permitted high purity gases to be injected into the ring so as to raise the pressure over a localized region of a straight section from its base value of 2-3 $\times 10^{-9}$ torr to any arbitrary value. Thus the target consisted of a uniform dilute channel of gas within the TPC/2γ beampipe (a fiducial volume of ± 1 meter from beam crossing), although the actual pressure bump spanned roughly ± 15 meters.

About 8 hours of running time were dedicated for each target: D_2, Ar, Xe. Approximately 50,000 events per target were collected, most of which are low-x, low-Q^2 data from electron triggers in the forward spectrometer. Electron triggers in the TPC itself represent higher Q^2 events, but comprise a smaller fraction of the data. Deuterons were observed cleanly in the TPC along with the usual e, μ, π, K, p. Full analysis should be completed by the Workshop on Internal Target Physics at Electron Storage Rings, October 14-16 at SLAC. (K. Van Bibber)

2. PEP ACTIVITY

PEP returned to colliding beam operation by mid-November. The start-up took longer than one might expect due to the necessary shakedown of the new equipment on the linac. The peak ring performance came up to interesting levels very quickly, but the the average performance was still below par. During December performance improved steadily and by the end of the month, the daily integrated luminosity had again reached 1 inverse picobarn. PEP and the other accelerator facilities were scheduled off for 48 hours at Christmas but ran through the New Year.

PEP ran relatively smoothly through January and February with two major down times due to RF and power supply equipment failures. The luminosity performance was very good with 800 nb^{-1} being delivered per day averaged over January. (E. Paterson)

PEP OPERATION (NOVEMBER–FEBRUARY)	HOURS	% OF SCHEDULED OPERATING TIME
SCHEDULED DOWN TIME	145	
SCHEDULED OPERATING TIME	2735	
HOURS THIS PERIOD	2880	
RING DOWN TIME	421	15
LINAC DOWN TIME	753	27.5
COLLIDING BEAMS + FILL/TUNE	1548	57
EXPERIMENTER ACCESS	15	0.5

3. SPEAR ACTIVITY

SPEAR continued operations for SSRL until November 11, when a changeover to colliding beam operation was initiated. The achievement of colliding beams was delayed by several days due to linac problems with positron beams, and linac reliability problems continued to limit available integrated luminosity. By the end of December the daily luminosity at 2.07 GeV/beam was at the expected value of 60 inverse nanobarns/day. Running for MARK III continued at this energy through February.

Machine physics work was done to confirm earlier bunch length data and to develop reproducible injection into a low emittance configuration. In January a two day shutdown of the linac allowed an opportunity to install an impedance structure in the East interaction region, which was shown to reduce the potential well bunch lengthening. Turbulent bunch lengthening still dominates the bunch length at these energies and currents, however. Initial efforts to establish good mini-beta configuration were not successful and were terminated for lack of time. (J. Harris)

4. SLC ACTIVITY

Although construction of the SLC is not scheduled to be completed until the end of this year, the commissioning of the subsystems has started. Construction of the north damping ring is essentially complete, and it was in operation during February. The south damping ring has been rebuilt, and it was brought into operation during February. The electron extraction system for producing positrons has been installed and will be tested later this spring. The positron return line is completely in place and under vacuum. The commissioning plan was to run as many of the components as possible in February, complete installation of the positron target system in March and April, and then begin running the entire system of north damping ring, south damping ring, and positron source — sometimes referred to as the 'three-ring circus'— until the SLC is finished.

Production of 50–megawatt klystrons is on schedule, and some 130 of these new klystrons have been installed in the gallery and are running routinely. Fabrication of all alternating gradient magnets for the arcs is complete, and the magnets are being installed.

The arc tunnels have been complete for some months and installation of the mechanical and electrical utilities in the tunnels is nearing completion.

Construction of the Collider Experimental Hall is proceeding, and although the contractor for this is somewhat behind schedule, he is promising completion in May.

This date is critical for installation of the final focus system and the MARK II detector, which are both on schedule. The steel framework for the building has been erected, and the interior work is nearing completion. All SLC systems are on schedule for beginning the commissioning of the machine at the end of this year. (D. Getz)

5. VAX ACTIVITY

Several DEC MicroVAX II workstations were received for installation at MCC. These will be used in the checkout and operation of SLC, supplementing the so-called COW's ("console on wheels"). Two additional MicroVAX II computers were installed for use on SLD.

A memory upgrade, including a new backplane, was done on the NIKHEF VAX 11/750 computer, increasing the machine's total memory from 2 megabytes to 4.25 megabytes. The memory controller on the ESA VAX 11/780 computer was replaced with a new EMC controller that permits using 64K chip memory; the total memory on this machine was increased from 4 megabytes to 8 megabytes. The ESA VAX also had a new RA81 disk drive installed, making an additional 456 MBytes more disk storage and the number of terminal ports was increased to 24.

The Ethernet network was extended to include the MCC VAX 11/780 and the new DEC Workstations and MicroVAX computers.

Preventive maintenance was performed on all 24 VAX computers after the March shutdown. (M. LaBelle)

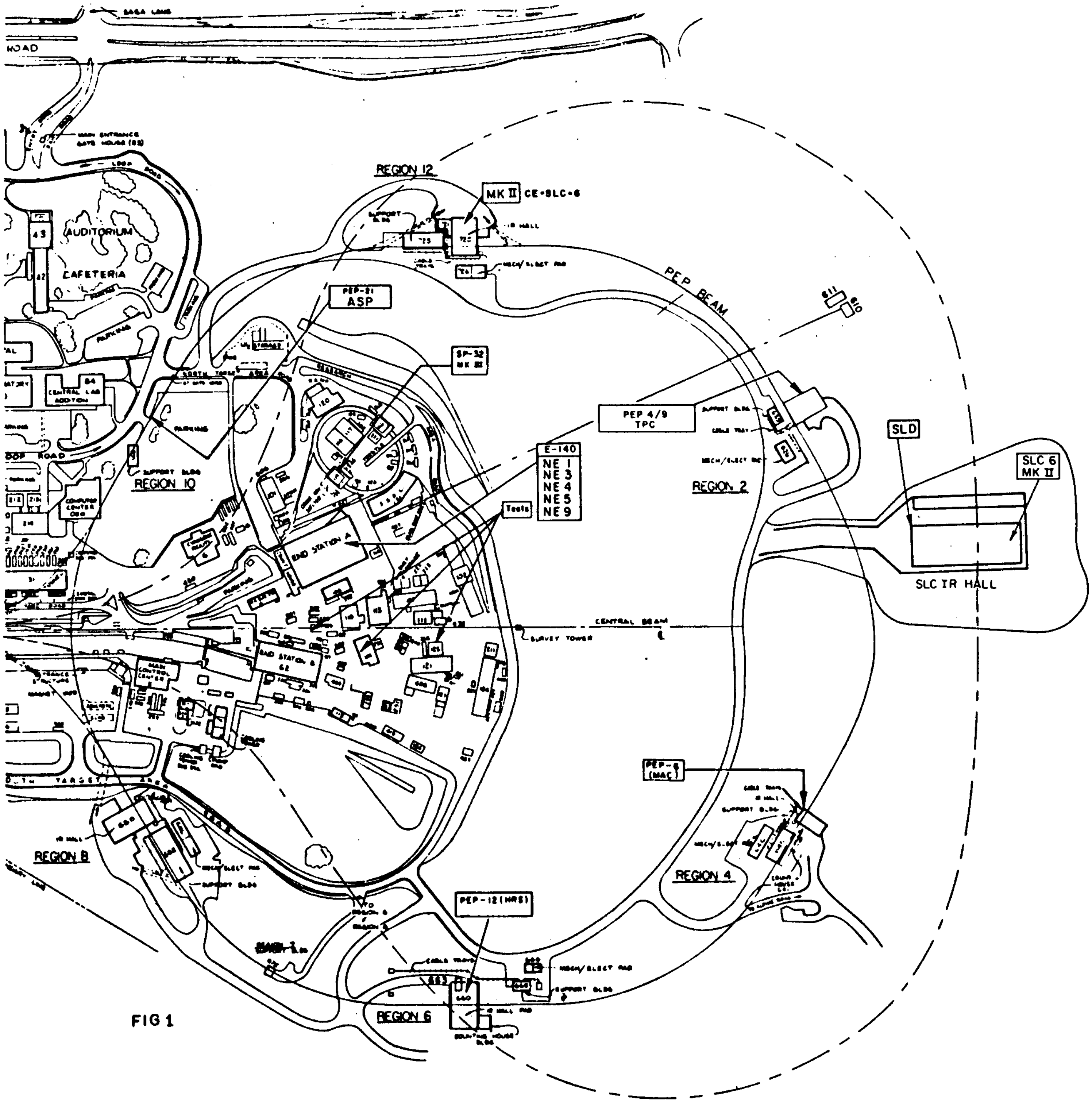
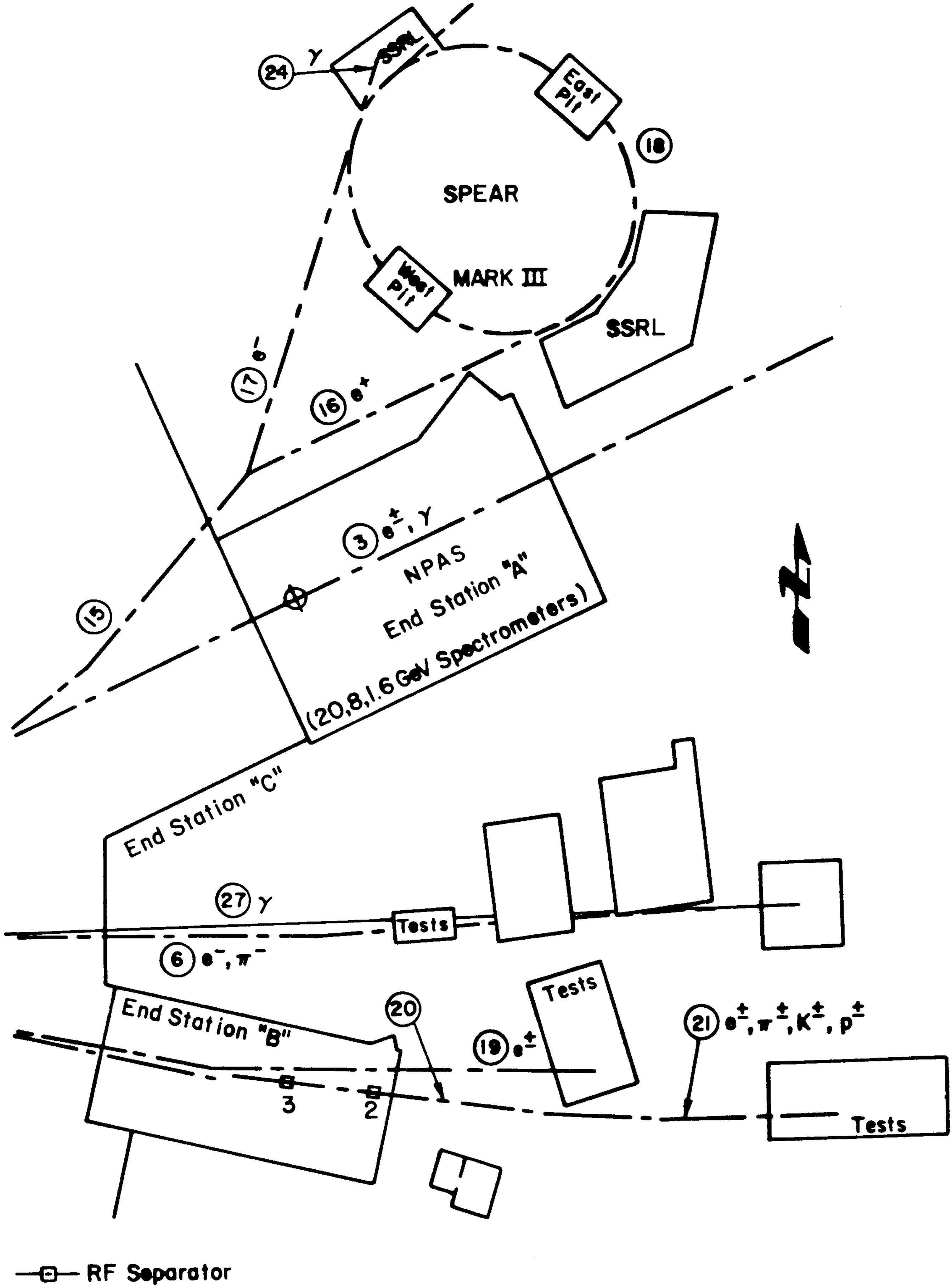

REGION 12
MK II CE-SLC-6
AUDITORIUM
CAFETERIA
PEP BEAM
PEP-21
ASP
SP-32
MK III
PEP 4/9
TPC
E-140
NE 1
NE 3
NE 4
NE 5
NE 9
Tools
SLD
SLC 6
MK II
SLC IR HALL
REGION 10
REGION 2
END STATION A
CENTRAL BEAM
SURVEY TOWER
PEP-6
(MAC)
REGION 4
REGION 8
PEP-12 (HRS)
REGION 6

FIG 1

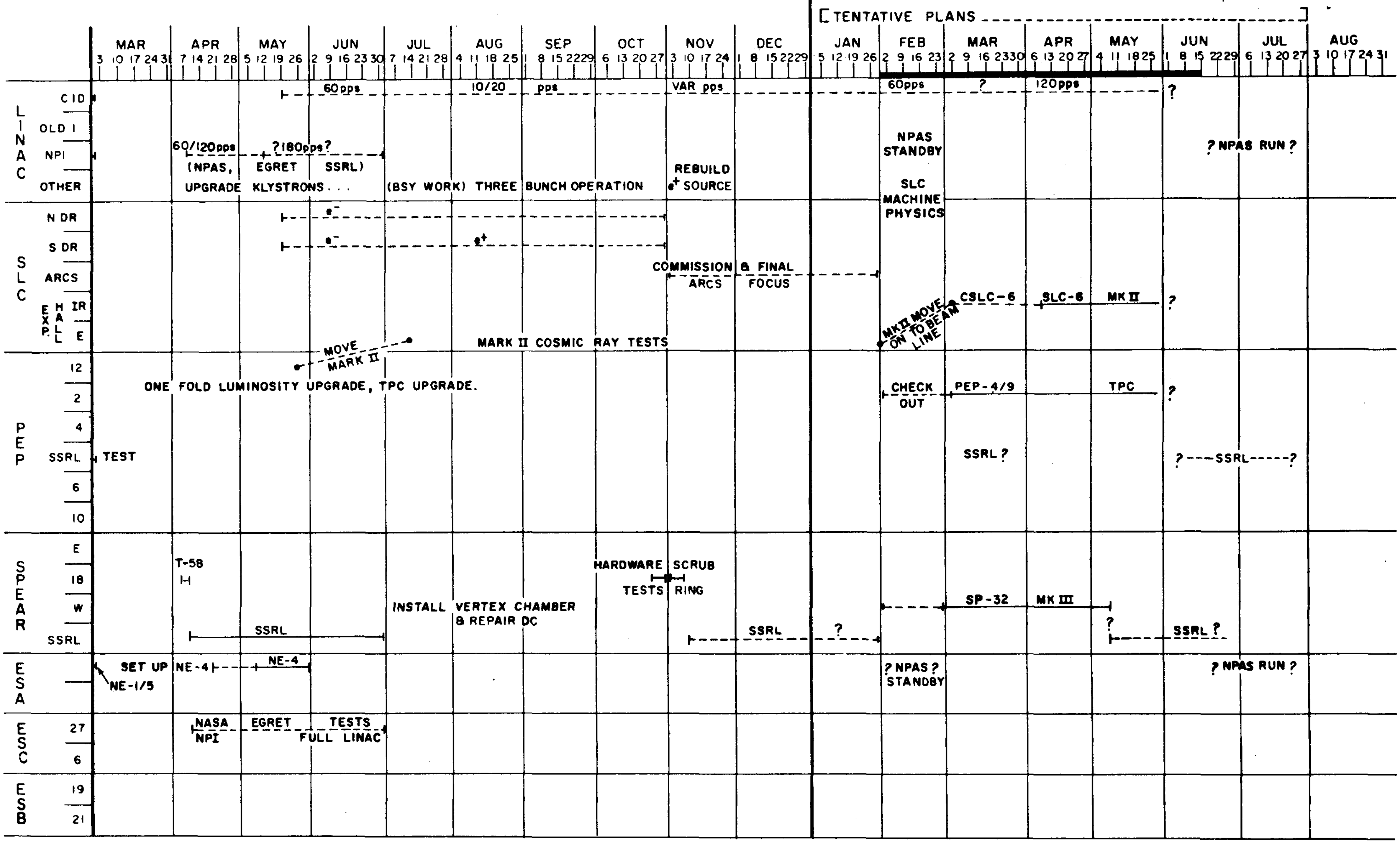


24
γ
SSRL
East Pit
18
SPEAR
MARK III
West Pit
SSRL
17 e⁻
16 e⁺
3 e±, γ
NPAS
End Station "A"
End Station "A"
(20,8,1.6 GeV Spectrometers)
15
End Station "C"
27 γ
Tests
6 e⁻, π⁻
Tests
End Station "B"
20
19 e±
21 e±, π±, K±, p±
3
2
Tests
RF Separator

FIG 2

LONG RANGE SCHEDULE

BR 4/9/86



STANFORD LINEAR ACCELERATOR CENTER

TABLE 1

March, 1986

TABLE OF APPROVED EXPERIMENTS

Number	Title	Experimenters	Date Approved Stage 1	Date Approved Stage 2	Status
E-140	Measurement of the x, Q , and Nuclear Dependence of $R = \sigma_\ell/\sigma_T$	AMERICAN U: R.Arnold,P.Bosted, G.deChambrier,S.ROCK,Z.Szalata CAL-TECH:B.Filippone,R.McKown, R. Milner, D. Potterveld CERN: A. Para LAWRENCE LIVERMORE NATIONAL LAB: F.Dietrich, J. Woodworth U.MASS; B.Debebe,R.Hicks,G.Peterson U.ROCHESTER:A.BODEK, G. Gerbier, K.Lang,P.Perez,E.Riordan,M.Virchaux ROCKEFELLER U: O.Fackler U.TEL AVIV:J.Alster,J.Lichtenstadt SLAC: R. Gearhart S.U.:K.VanBibber,L.Whitlow	12/3/84		Complete
SP-32	MARK III Detector at SPEAR	C.I.T.: D.Coffman,G.Dubois,J.Hauser, D.HITLIN,R.Schindler, Y. Zhu SLAC: K.Bunnell, R.Cassell,D.Coward, U.Mallik,R.Mozley,A.Odian,W.Toki,F.Villa,N.Wermes W.Wasserbaech,D.Wisinski,G.Wolf UCSC: C.Heusch,L.Koepke,W.Lockman,J.Perl, R.Partridge,J.Perrier,H.Sadrozinski,M.Scarletella, T.SCHALK, A.Seiden, A.Weinstein U.ILLINOIS: G.Blaylock,B.Eisenstein,G.Gladding, C.Simopoulos,I.Stockdale,J.Thaler, B.Tripsas,A.Wattenberg,W.Wisniewski U.WASHINGTON: T.Burnett,J.Brown,V.Cook,A.Duncan, P.Mockett,B.Nemati,H.Willutzki M.I.T.: T. Bolton UNIV.CATHOLIQUE DE LOUVAIN:D.Favart	5/16/81		Inactive
PEP-4/9 (TPC)	TPC	LBL: M.Alston-Garnjost, A.B.-Galtieri, A.Barnes, A.Bross, W.Carithers, O.Chamberlain, A.Clark, O.Dahl,C.Day, B.Eberhard, R.Kenney, S.Loken, B.Gabioud, W.Hofmann, G.Lynch, R.Madaras, J.Mallat, J.Marx, D.Nygren, P.ODDONE, M.Pripstein, B.Robrish,M.Ronan, R.Ross, G.Shapiro,M.Stevenson, R.VanTyen, W.Wenzel, R.Cobb, A.Cordier, C.Covey, J.Eastman, G.Przyblski,P.Salz, E.Wang, J.Wissmar UCLA: C.Buchanan, J.Hauptman, D.Park, W.Slater, D.Stork U.MASS.:R.Kofler,S.Maxfield,J.Huth UCR:W.Gorn,K.Kwong,J.Layter,B.Shen,G.VanDalen JOHNS HOPKINS: B.Barnett, B.Blumenfeld, C.-Y.Chien, J.Hylen, L.Madansky,A.Pevsner	1/21/77		Inactive

Number	Title	Experimenters	Date Approved		Status
PEP-4/9 (continued) (TPC)		U.TOKYO: J.Chiba, H.Fujii, T.Fujii, T.Kamae, K. Maruyama U. BONN: R. Sauerwein UCD: W.Ko, R.Lander, R.McNeil, K.Maeshima, D.Pellett, J.Smith, W.Wagner, C.Williams, C.Zeitlin UCSD: D.Bintinger, G.Masek, E. Miller, J.Stronski, M.Sullivan, W.Vernon UCSB: A.Barker, T.Browder, M.Cain, D.Caldwell, A.Eisner, U.Joshi, A.Lu, B.Magnuson, S. Yellin CARNEGIE-MELLON: G.Bobink, J.Nash NIKHEF: F.Erne, H.Paar, J.C.Sens			
PEP-6 (MAC)	A Lepton Total Energy Detector	U.COLORADO: W.Ford, N.Qi, A.Read, J.G.Smith U.WISCONSIN: M.Delfino, J.Johnson, T.Lavine, T.Maruyama, R.Prepost, U. UTAH: P. Verdini U. HOUSTON: H.Blume, R.Hurst, K.Lau, J.Venuti, H.Wald, R.Weinstein NORTHEASTERN U: H.Band, M.Gettner, G.Goderre, J.Morimisato, R.Polvado, J.Sleeman, D.Sanders D.Shambroom, E.vonGoeler FRASCATI: T.Camporesi, R.DeSangro, A.Marini I.Peruzzi, M.Piccolo, F.Ronga, SLAC: W.Ash, G.Chadwick, L.Moss, R.Messner, D.Ritson, D.Wiser, R.Zdarko CORNELL: B. Heltsley SSC/LBL: D. GROOM STANFORD U.: H.Nelson, L.Rosenberg	1/21/77		Complete
PEP-12 (HRS)	High Resolution Spectrometer	ANL: M.DERRICK, P.Kooijman, J.Loos B.Musgrave, J.Schlereth, L.Price, K.Sugano INDIANA U.: P.Baringer, D.Blockus, B.Brabson, C.Jung, H.Neal, H.Ogren, D.Rust U.MICHIGAN: C.Akerlof, G.Bonvicini, J.Chapman, D.Errede, P.Kesten, D.MEYER, D.Nitz, R.Thun PURDUE: S. Abachi, B.Bylsma, R.DeBonte, K.K.Gan, D.Koltick, F.Loeffler, E.Low, R.McIlwain, D.Miller, C.R.Ng, L.K.Rangan, E.Shibata LBL: B. Cork	1/29/78		Complete
PEP-21 (ASP)	Search for Unseen States Using Photon Tagging	SLAC: G.Bartha, D.BURKE, C.Hawkins, R.HOLLEBEEK, M.Jonker, L.Keller, C.Matteuzzi, N.Roe, T. Steele, R.Wilson M.I.T.: A.Johnson, J.S.Whitaker U.WASHINGTON: C.Hearty, J.Rothberg, K.Young	5/14/83		Complete

Number	Title	Experimenters	Date Approved	Status
SLC-6	MARK II at the SLC	LBL:G.Abrams,A.Baden,J.Boyer,F.Butler, P.Drell,G.Gidal,G.Goldhaber,J.Haggerty, D.Herrup,I.Juricic,J.Kadyk,W.Schmidke, P.Sheldon,G. TRILLING,D.R.Wood CAL TECH: B.Barish,G.Fox,T.Gottschalk, M.Nelson,C.Peck,F.Porter,R.Stroynowski, A.Weir, D. Wu, E.Soderstrom UCSC: D.Dorfan,C.Heusch,L.Koepke,A.Litke, H.Sadrozinski,T.Schalk,A.Seiden,A.Weinstein U.COLORADO:W.Ford,J.Smith,P.Weber,S.White, T.Allison,M.Alvarez,F.Calvino U.HAWAII: A.Breakstone,R.Cence,F.Harris, A.Koide,S.Parker,D.Yount U.MICHIGAN:C.Akerlof,G.Bonvicini,J.Chapman,D.Meyer, W.Koska,D.Meyer,D.Nitz,R.Thun,M.Petradza, R.Tschirhart, H.Veltman JOHNS HOPKINS:B.Barnett,J.Matthews,J.Hylen SLAC: J.Alexander,J.Ballam,T.Barklow, J.Bartelt,K.Braune,A.Boyarski,F.Bulos, P.Burchat,D.Burke,D.Coupal,D.Cords,H.DeStaebler, J.DORFAN, R.C.Field,G.FELDMAN,T.Glanzman,T.Himel, R.Hollebeek,G.Hanson,K.Hayes,W.Innes,J.Jaros, W.Kozanecki,A.Lankford,R.Larsen,V.Luth, K. Moffeit, R.Ong,M.Perl,A.Petersen,R.Pitthan,P.Rankin,K.O'Shaughnessy	5/14/83	Inactive
	SLD Detector for the SLC	U.BRITISH COLUMBIA: D. Axen CAL.TECH: D.Hitlin, G. Eigen, F. DeJongh, R. Schindler CAL.STATE U.-NORTHRIDGE: R.Kennett U.CINCINNATI:R.Endorf,B.Meadows,M.Nussbaum,R.Johnson U.COLORADO: J.Carr, L.Cremaldi, U.Nauenberg COLUMBIA: C.BALTAY,E.Hyatt,S.Manly,M.Shaevitz,S.Smith UNIV.of FERRARA: G.Callegaris,L.Piemontese FRASCATI: T.Camporesi,R.DeSangro,I.Peruzzi,M.Piccolo, U.ILLINOIS: J.Brown,R.Dobinson,G.Gladding,D.Lesny,J.Thaler M.I.T.:W.Busza,J.Friedman,A.Johnson,H.Kendall,V.Kistiakowsky, L. Osborne,L.Rosenson,R.Verdier,S.Whitaker,R.Yamamoto,F.Taylor NORTHEASTERN U.:.H. R. Band PRINCETON: D.Coyne, M.Cavalli-Sforza U.PADOVA: D. Bisello, M. Loreti U. PERUGIA: R.Battiston, G-M.Bilei, A.Bienvenuti, R.Calstadi,P.Cenci, A.Codino,G.Mantovani,M.Pauluzi,C.Vannini,P.G.Verdini RUTHERFORD: C.Damerell, A.Gillman, F.Wickens SLAC: W.Ash,V.Ashford,W.Atwood, M.BREIDENBACH, F.Bird,K.Bunnell,W.Dunwoodie,S.Ecklund, T.Hansl-Kosanecki,G.Hallewell,P.Kunz,D. Leith, H.Lynch,C.Prescott,B.Ratcliff,L.Rochester,A.Rothenberg,O.Saxton, D.Schultz,S.Shapiro,T.Shimomura,T.Weber,S.Williams,C.Young TRIUMF: G. Ludgate, C. Oram UCSB: D.Caldwell, A.Lu,R.Morrison,M.Witherell,S.Yellin D. Bauer, D. Hale U.TENNESSEE: J.Brau, W.Bugg, A. Weidemann VANDERBILT U.: A.Barnes,S.Csorna,R.Panvini,T.Reeves U.VICTORIA: A.Astbury,G.Beer,R.Dubois,R.Keeler,G.Mason, L.Robertson, T.Hodges,R.Langstaff U.WASHINGTON: V.Cook,R.Davisson,A.Duncan,A.Guy, P.Mockett,B.Nemati,J.Rothberg,J.Rutherfoord,R.Williams,K.Young U.WISCONSIN: J.Johnson,T.Maruyama,R.Prepost	5/4/84	Planning

Number	Title	Experimenters	Date Approved	Status
		NPAS PROGRAM		
NE-1	ElectroproductCheckout/e Delta Isobar in Nuclei	ANL: D.Geesaman, M.Green, R.Holt, H. E. JACKSON, W.Kleppinger, R. Kowalczyk, T.-S.H.Lee, J. Schiffer, B. Zeidman	5/21/84	Running/ Complete
NE-4	Electron-Deuteron Scattering at Large Momentum Transfer at 180 Degrees	AMERICAN U.: R.Arnold, P. BOSTED, J. Gomez, A. Katramatou, G.Petratos, S. Rock, A. Sill, Z. Szalata SLAC: R. Gearhart U. MASS. B. Debebe, R.Hicks, G. Peterson ANL: R. Holt, H. Jackson	5/21/84 Ext.9/27/85	Set-up
NE-5	Electroexcitation of the Delta in Nuclei	U. VIRGINIA: D. Day, R.Khalil, Z.E.Meziani, R.Minehart, R.Sealock, S. THORNTON, R. York FLORIDA STATE U.: L.Dennis,K. W. Kemper	5/21/84	Running/ Complete
NE-9	Measure Transverse & Longitudinal Response Functions for Several Nuclei at Momentum Transfer Near $Q^2 = 1\ (GeV/c)^2$	U. VIRGINIA: Z.E.MEZIANI,R.Sealock, D. Day, K.Giovanetti,J.McCarthy, R. Minehart, O.Rondon-Aramayo,S.Thornton FLORIDA STATE: L. Dennis, K.Kemper	9/27/85	Planning

Number	Title	Experimenters		Date Approved	Status
D-24	SSRL Dedicated Time	SLAC/SSRL:	H. Winick	12/04/75	Planning
P-0	Operator Training	SLAC:	D. Tsang		Planning
P-1	Beam Dynamics Tests for the SLC	SLAC:	R. Stiening		Inactive
P-6	General Equipment Checkout	SLAC:	G. Loew		Test
P-7	Positron Source Tuneup	SLAC:	G. Loew, R.Miller	10/01/71	Test
P-9	SPEAR Tuning Test	SLAC:	G. Loew		Test
P-12	Accelerator Evaluation	SLAC:	D. Tsang		Test
T-58	SPEAR Electron Storage Ring Tests	SLAC:	J. Rees, J.Harris	11/21/71	Planning
T-172	Beam Line 6 Checkout	SLAC:	R. Gearhart	10/24/74	Inactive
T-276	Beam Line 27	SLAC:	J. Murray	11/15/79	Planning
T-282	PEP Accelerator Studies	SLAC:	E. Paterson	1/18/80	Planning
T-296	19 Line Setup and Checkout	SLAC:	T. Fieguth	10/22/80	Inactive
T-300	Cerenkov Ring Imaging Detector	SLAC:	S. Williams	1/13/81	Planning
T-313	SLC Damping Ring Checkout	SLAC:	S. Ecklund	12/22/81	Planning
T-328	Test of Cerenkov Counters for $e^{\pm}$ Identification	U. WASH.:	V. Chaloupka	12/21/82	Inactive
T-346	Test B/L 20/21 at Low Momenta	SLAC:	R. Gearhart S. Shapiro	11/9/83	Inactive
T-348	SLD Drift Chamber Tests	SLAC:	C. Prescott	11/29/83	Ready to Run
T-349	SLC Calorimeter Tests	U. WASH.: U. WISC.: M.I.T.:	P. Mockett J. Johnson V. Kistiakowsky	11/17/83	Planning

Number	Title	Experimenters		Date Approved	Status
T-358	Silicon Micro-strip Detector Test	UCSC: U. HAWAII: SLAC:	A. Litke S. Parker S. Shapiro	7/3/84	Planning
T-367	Flight Crystal System Test	HEPL:	E. B. Hughes	10/15/84	Planning
T-373	Bm.Test/Prototype-Drift Cham.	IHEP-Beijing	Bai Jing Zhi	2/7/85	Inactive
T-374	Shower Counter Prototype	IHEP-Beijing	Li Chen	2/7/85	Inactive
T-384	Calibration of Gamma Ray Beam Intensity Monitor	HEPL:	J. Mattox	9/24/85	Ready to Run
T-386	Resolution Test	U.C.Davis	K. Sparks/ K. Maeshima	10/18/85	Planning
T-387	TPC VC Test	SLAC:	G. Godfrey	12/31/85	Complete
T-388	Calibration of EGRET Telescope	HEPL:	E. B. Hughes	1/3/86	Complete
T-390	Gas Injection Target at IR-2	HEPL:	K. VanBibber	1/13/86	Planning

STATUS:

Running = Experiment is in data collection phase and was a prime user of accelerator time.
Checkout = Experiment is in checkout phase and used accelerator time for checkout purposes.
Setup = Experiment was being setup in the research yard, or PEP I.R.
Inactive = Experiment was inactive in the research yard.
Construction = Experiment and/or beam is under construction.
Ready to Run = Experiment ready for future scheduled run.
Parasiting = Used parasite beam time.
Complete = Experiment completed.
Test = Test run performed.
Planning = In design & planning stage.
Upgrading = Experimental equipment is being upgraded.
Repair = Down for Equipment Repair

9. ACCELERATOR AND RESEARCH OPERATIONS

Stanford Linear Accelerator Center

November 1985 – April 1986

A. Operating Hours (Manned Hours)

Physics Beam Hours[1]	Nov	Dec	Jan	Feb	Total
Machine& Particle Physics	504	494	592	604	2,194
Scheduled Downtime	64	49	83	0	196
Unscheduled Downtime	152	201	69	68	490
Total Operating Hours	720	744	744	672	2,880

B. Experimental Hours[2]

1. Particle Physics

EXPERIMENTAL AREA OR BEAMLINE[3]	EXPERIMENTAL TIME (Actual Hours)	TEST AND CHECKOUT HOURS	TOTAL EXPERIMENT HOURS
PEP			
IR- 2	1,362		1,362
IR- 4	1,362		1,362
IR- 6	1,362		1,362
IR- 8			
IR-10	1,362		1,362
IR-12		1,362	1,362
SPEAR			
EAST PIT			
WEST PIT	1,122		1,122
ESA 3	977	102	1,079
ESB 19		424	424
20		139	139
14			
8			
ESC 27		250	250
26/6		36	36
TOTAL	7,547	2,313	9,860

2. Machine Physics

PEP 24, SPEAR 234, LINAC 378. 636

3. SSRL (Dedicated Time at SPEAR)[4] 227

TOTAL EXPERIMENTAL HOURS 10,723

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[1] Number of hours accelerator is run with one or more beams excluding accelerator beam tune-up and other nonphysics beam time.

[2] Number of hours an experiment is run including actual beam hours and beam down time "normal to the experiment."

[3] Refer to Figures 1 and 2 for beam line locations and experimental areas.

[4] Accelerator Beam available to SPEAR storage ring.

C. Overall Experimental Program Status

1. NPAS Experiments	Factored Hours[1]
Approved research hours at beginning of period	836
Hours run during the period	257
New Hours approved during the period	0
Approved hours remaining at end of period	520*

2. PEP Experiments	Actual Hours
Approved research hours at beginning of period	12,836
Hours run during the period	6,810
New Hours approved during the period	0
Approved hours remaining at end of period	6,026

2. SPEAR Experiments	Actual Hours SPEAR
Approved research hours at beginning of period	1,760
Hours run during the period	1,122
New Hours approved during the period	0
Approved hours remaining at end of period	638

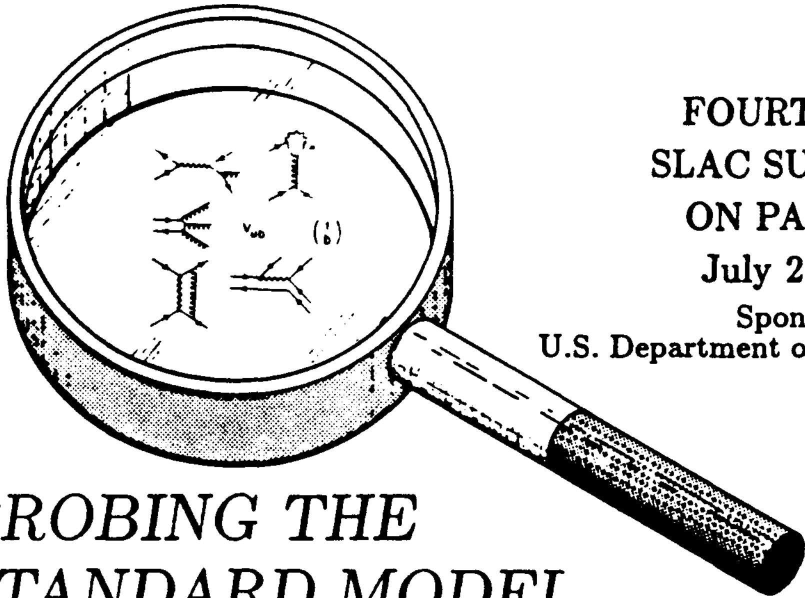
3. Electronic Experiments	Factored Hours
Approved research hours at beginning of period	346
Hours run during the period	221
New Hours approved during the period	0
Approved hours remaining at end of period	0**

[1] Factored hours are represented by the formula $T_c = T_0(R + 20)/200$ where T_c = charged hours, T_0 = total hours beam was available to the experimenter for both checkout and data taking, and R = the average pulse repetition rate. Maximum for $(R + 20)/200$ is 1.5 even if the calculated amount exceeds this value.

*NE–3: completed.

**E–140: completed.

Stanford Linear Accelerator Center
Stanford, California



FOURTEENTH ANNUAL
SLAC SUMMER INSTITUTE
ON PARTICLE PHYSICS
July 28 - August 8, 1986

Sponsored jointly by the
U.S. Department of Energy and Stanford University

PROBING THE STANDARD MODEL

This year's Summer Institute examines the experimental and theoretical basis for the Standard Model of strong and electroweak interactions. In addition, a series of lectures will discuss present and future technologies for data acquisition and computing.

The format of the Institute will be two separate sessions – a seven-day school of a generally pedagogic nature followed by a three-day topical conference. The school will consist of lectures each morning with time for early afternoon study and informal discussion, followed by an organized discussion session in the late afternoon during which participants will meet with lecturers to raise questions and discuss problems arising from the day's lectures. The topical conference format will have each day fully scheduled with five or six invited talks. The program of the Institute is designed primarily, but not exclusively, for post-doctoral experimental physicists.

OUTLINE OF TOPICS

SUMMER SCHOOL (July 28th – August 5th)

R. Field	Perturbative QCD
J. Dorfan	Experimental Tests of QCD
H. Harari	Electroweak Theory – Standard and Beyond
B. Winstein	Experiments in Conflict with Electroweak Theory: Are There Any?
F. Gilman	Phenomenology of Heavy Quark Systems
R. Schindler	Heavy Quark Spectroscopy
P. Kunz	Some Aspects of Computing in High Energy Physics
M. Breidenbach	Data Acquisition for High Energy Physics Experiments
R. Larsen	Custom Design of Electronics for High Energy Physics

TOPICAL CONFERENCE (August 6th – 8th)

Invited talks will be presented on recent experimental and theoretical results of current interest.

Participants must obtain their own travel and subsistence funds. Low cost dormitory-style housing on the Stanford campus is available for 50-75 selected applicants from outside the Stanford community. Transportation between SLAC and the campus will be provided. A registration fee of $200 will be charged and should accompany applications.

Those interested in attending the Summer Institute on Particle Physics at SLAC should write before May 31, 1986 to Eileen C. Brennan, Coordinator of the Summer Institute on Particle Physics, Stanford Linear Accelerator Center, P. O. Box 4349, Bin 62, Stanford, California 94305.

DISCLAIMER

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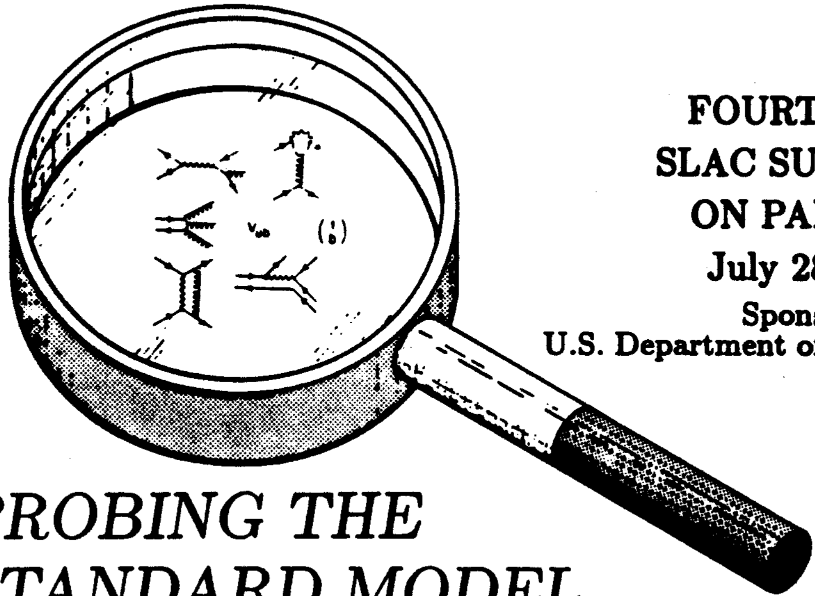
Stanford Linear Accelerator Center
Stanford, California



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[illegible]	[illegible] Spectroscopy
[illegible]	[illegible] of Computing [illegible]y Physics
[illegible]	Data Acquisition for High Energy Physics Experiments
R. Larsen	Custom Design of Electronics for High Energy Physics

DO NOT MICROFILM THIS PAGE

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From: SLAC – Bin 20
P. O. Box 439
Stanford, CA 94305

TO:

DO NOT MICROFILM
COVER