Monthly Progress Report

Stanford Synchrotron Radiation Laboratory

June 2003

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A. SPEAR 3 PROJECT SUMMARY

1. Technical Progress

The end of June marks the completion of the 3rd month of the SPEAR 3 Installation Program. The planned activities continue ahead of schedule.

After the successful removal of SPEAR2 hardware in April, the contract for constructing new heavy duty concrete floors for the ring tunnel and the power supply building were begun. The floor for the power supply building was successfully completed in mid-May and the tunnel floor was completed in mid-June –one week ahead of schedule. This allowed the task of establishing new survey and alignment monuments in the tunnel to also move ahead of schedule. In addition the rather significant and unplanned seismic retrofit of the cable support structure in the power supply building was completed.

The contracts for tunnel floor anchor bolts and the positioning and grouting of magnet raft support plates were awarded in early June. The core drilling for nearly 2000 anchor bolts began June 30. The last major contract for the installation of power and signal cables within the tunnel with connections to the power supply and control systems was out-to-bid this month. Award will take place July 10.

Additional requirements for radiation shielding have now been provided by the SLAC Radiation Physics Group. This additional shielding is required for the injection area, the beam stopper, and for the exit walls of the photon-beams. Designs have been reviewed and will be finalized by mid-July with installation in October, 2003. This shielding will allow initial accelerator operations to 100 mA, the limit also currently imposed by a number of beam line optical components. The evaluation of further shielding needs that may be required for up to 500 mA operations is currently being completed by the Radiation Physics Group. The goal is to accomplish any additional shielding requirements by the end of the first 7-8 month commissioning/operations periods such that, consistent with beam line optics, higher current operation can commence at the beginning of the following run cycle (Fall, 2004)

Another requirement specifies that fences are required to restrict access to the tunnel roof. The fence has been ordered and will be installed in mid-August.

Existing roof blocks have been inspected by the SLAC Earthquake Committee and SPEAR 3 consultants have provided further detailed evaluations. Four new blocks have been ordered to replace those with stress cracks possibly due to additional loading of other blocks.

Design and production of technical components for Power Supplies, beam line front ends, cable plant and RF systems were completed this month is preparation for installation.

All four RF cavities (while 1.5 years late) have now been received from the manufacturer. Three have been assembled in their rafts, conditioned, tested, and are ready for operation. Tests for the last unit are delayed due to the failure of the 500kw klystron used in the test stand. Of the two new SLAC-built klystrons and two repaired Marconi-built units (all 1.2 Mw), the first SLAC unit has been tested and delivered to PEPII. The second SLAC unit is being prepared for acceptance

tests and will be used to test the 4th SPEAR 3 cavity noted above. One of the 4 klystrons will be delivered to SPEAR 3 before October.

Two of 54 SPEAR 3 magnet rafts remain for final alignment with vacuum chambers and electrical check-out. This will be complete by mid-July. Final hook-up of LCW systems in the tunnel and HCW piping to the RF system are scheduled for August. Some vacuum straight section components remain on the critical path for installation with respect to the current advanced schedule. Efforts are underway to modify the installation schedule with consideration of these conditions.

2. Cost Data

The total project costs and commitments through June 2003 are provided in Table A1. The integrated costs and commitments per month are plotted in Fig. A1

Table A1
Costs and Obligations
(through June 2003)

	K$	
	Direct	Direct & Indirects
Costs	43,471	49,227
Commitments	3,024	3,629
Total	46,495	52,856

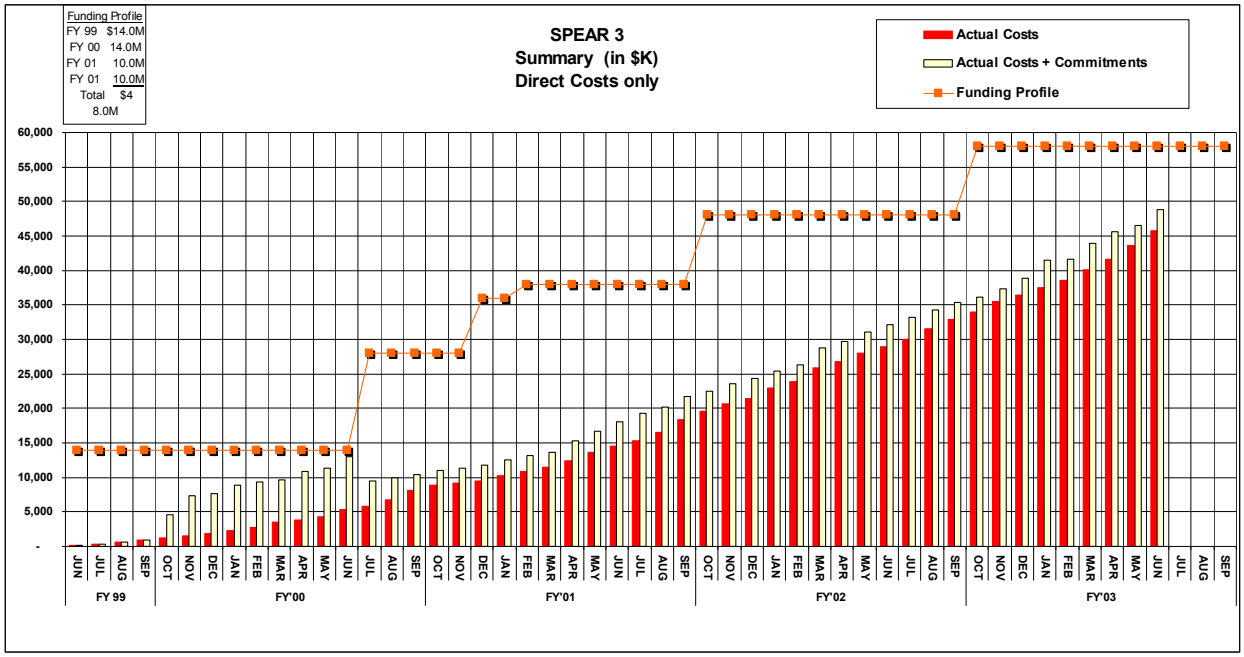


Figure A1

B. Design and Fabrication Reports

1.1 Magnets and Supports

- Work is near completion on all 54 magnet rafts. Only electrical checks remain for 3 rafts and vacuum chamber re-alignment for 2 of the transition units to the East and West straight sections.

- The injection BTS work is near completion pending alignment of support I-beams of the BTS raft and mounting "caps" on shielding walls for I-beams. LCW is complete and shielding requirements are being incorporated into the final design.

- Septum magnet measurements have been done using material to shield the magnet fringe fields with results as low as 5 gauss-meters, which is the design leakage field tolerance. End plates will now be modified to clear the vacuum chamber and hall probe measurement done which will finalize the magnetic measurements for the septum, after which the magnet will be installed on the support frame.

1.2 Vacuum System

- Completed 3 of 5 injection transitions. Remaining 2 will be complete early July.

- First lot of pumps arrived. Install onto girder in early July (waiting on pump supports). 150 L/S pump delivery is 1.5 months late (may need to install in tunnel).

- Completed RF HOM chambers and spools. Installed two on RF rafts.

- Machining of RF pump chamber parts completed.

- RF transition chamber machining in process.

- RF Bellows completed and baked.

- Injection Bellows completed and baked.

- Beam Line 4 and 7 wiggler chambers completed.

- Tune driver chamber completed, baked, and stored.

- ID exit masks completed and baked.

- Bend magnet exit masks completed and baked.

- Injection kickers are being assembled and welded.

- BL5 transition pump chamber parts complete.

- Other components in fabrication and nearing completion include:
  - Injection septum chamber
  - Standard straight section chambers
  - PPS stopper
  - Beam Line 11 Bellows
  - Synchrotron Light Monitor front end
  - DCCT

1.3 Power Supplies

- Testing of the dipole system was completed at power levels up to 400kW.

- All magnet power supplies have been received except for 10 Intermediate Power Supplies. Delivery of 5 completed power supplies from IE Power is scheduled for the first week in July with the balance due the 4th week of July. These delivery dates will support installation.

- Bench testing of 150 CANDI (Computer analog and digital interface) boards for the bipolar power supplies was completed. CANDI boards were installed on the MCOR30 power supplies.

- Schroff Euro-card crates and power supplies were installed in the bipolar power supply racks. These supply 5V to the multi-channel controller CPUs. It was observed that the CPUs occasionally do not boot-up when 5V power is applied. This problem is being investigated.

- All free-standing and rack-mounted power supplies have been delivered to the staging area in B130.

- All WBS 1.3 work orders have been closed effective the close of business June 30th.

1.4 RF System

Cavities

- Cavity SP3-01 has been successfully RF processed up to 850 kV gap voltage.

- Cavity SP-02 processed up to 850 KV without incident.

- Cavity SP3-03 was processed up to 850 KV CW and appeared stable for >15 hours, at which point the 500kW klystron of the test facilities developed a fault and subsequent investigations revealed that it had arced across the gun ceramic. The klystron did not shut-off and the event caused oil to escape through a faulty O-ring seal. The gun HT tank has been removed and extensive assessment of the ceramic condition has been made. During this assessment, the klystron ion-pump current increased from 0.2μA to ~10μA, indicating that a vacuum leak may exist in the gun ceramic vicinity. As yet a leak has not been identified and investigations are continuing. The fact that this klystron may not now

be used to process the remaining SPEAR3 (and PEP-II) cavities may delay both the SPEAR3 and PEP-II installation schedules during July – September 2003. It has been proposed that the 1.2 MW, 476 MHz test stand be used to feed power to the cavities by re-routing the waveguide in the test bay of building 44. Work is underway to enable this re-configuration to be performed, as it requires not only additional waveguide installation, but also the incorporation of all of the cavity interlocks to a klystron system which did not originally have this functionality. There are also PPS issues to resolve whereby PPS interlocks must directly interface to the 1.2 MW HVPS system. As it stands the processing that has been performed for cavity SP3-03 is deemed sufficient for installation on SPEAR3.

- Cavity SP3-04 was baked several times, each failing due to excessive pressure increases as the oven temperature rose. Further investigations of the cavity assembly revealed that the RF window ceramic was cracked at its braze junction. This window was consequently replaced and the cavity successfully re-baked. The cooling circuits have been attached and the cavity itself is now installed in the test bunker and is ready to start processing following the above test stand preparations utilizing Klystron S/N 04 (see below).

Klystron

- High power testing of the SLAC build 1.2 MW klystron S/N 03 has been completed and will be installed on PEP-II in the HER region 8 during the summer downtime.

- The second SLAC built klystron S/N 04 is now on the high power test stand and will commence testing in the next day or so. Once testing has reached ~ 200kW, the waveguide system will be reconfigured to conclude the RF conditioning of the SPEAR 3 and PEP-II cavities and will be switched back again to klystron testing once complete.

- The 2 CPI repaired klystrons are expected at SLAC on July 11 and July 22. These will be tested immediately following the SLAC S/N 04 tube.

Low Level RF

- The 5 IQA modules for SPEAR 3 have almost completed testing, requires a completed SP3 clock module to conclude testing. The Arc Interlock Modules are completed for SP3. The repaired VCXO's for the SP3 clock module have not yet arrived and are imminent; these are holding back the testing completion of the IQA modules. Expect to have all LLRF modules tested and completed by mid August.

1.5 Instrumentation and Control Systems

- Work on the computer control system continued with detailed programming of MCOR power supply controllers and BPM data acquisition system, on-going configuration of the database and history buffers, definition of thousands of EPICS process variables, and specification of operator control panels. Production of MCOR digital control boards was completed and planning for full crate testing of the MCOR system began. Most network components have been ordered.

- The automated testing of the 60 4-button-multiplexed BPM processing modules from Bergoz is in progress and is scheduled for completion by mid-July. Interconnection components needed between the BPM processing system are being fabricated and installation of system components into racks has begun. BPM patch panel fabrication is near completion, and jumper cable production by an outside company is in progress. The contract for AC power installation for the East and West I&C rooms has been issued.

- The designs of the LO, Clock and Test Tone fan-out units are complete and fabrication of the units is in progress.

- The design of the Injection Timing Controller, which communicates with the Booster RF Signal Generator, continues with delivery expected at the end of July.

- Detailed configuration of the programmable logic controller systems for the vacuum and magnet water protection interlocks is in progress. Production of the Orbit Interlock Position Limit Detector chassis and the Summary Chassis is underway.

- Fabriction of the Average Current Monitors for the Beam Containment System is complete. The design of the Long Ion Chamber (LION) control chassis is complete and that for the Beam Current Interlock is in progress.

- Installation of I&C equipment into racks is in progress.

1.7 Beam Line Front Ends

- All ID fixed masks have been brazed. This completes the fabrication of all parts planned for this WBS category.

1.8 Facilities

- The high conductivity water (HWC) system pumping skid was installed in May (see May progress report). The design of the piping system from the skid to the Klystron station was reviewed and a new routing was selected to greatly reduce costs. The new design is nearing completion. The piping installation together with final electrical connections is scheduled for completion in early August.

- As of the end of June 2003, eighty percent of the LCW modifications, mainly in the West and East straights, have been completed. The work completion includes the Phase 1 and Phase 2 of the project. Phase 1 involves the construction of the underground LCW pipe system. The Phase 2 work involves above ground LCW piping systems.

C. Installation Reports

1.9.1 Mechanical Systems

The SLAC Metrology group made rapid progress in establishing the new monument network for the ring. Readings were taken to all monuments inside the SSRL buildings and beamlines, referenced to the few existing monuments in the East and West straights of SPEAR and then values established to the new SPEAR monuments in the tunnel. (See section 2.0.2 for additional survey details).

SLAC Metrology group setting new survey monuments in the SPEAR tunnel

After the network was complete, the Metrology group began the layout of alignment points on the ring floor which are used to position hole templates. The group painted through the templates to mark the floor with color coded dots which tell the diameter and depth of each of approximately 2,000 holes. By June 27th about 90% of the holes had been marked clearing the way for the core drilling contactor to begin ahead of schedule. The templates can be seen in the photographs below.

Raft support plates being placed onto marked holes- note hole templates in background

After the ring floor holes were marked we placed 18 Raft supports over the marked holes and then surveyed the precision pin in each of the support plates to verify proper locations. The results were very good, pins within 1/16”, easily within the support plate hole tolerances. Following this a LCW header was rolled into the ring and set over its hole pattern, see photo below, and verifying the proper location for these units as well. These units were then removed to allow core drilling operations to begin.

Test placement of standard cell LCW headers behind Raft supports

Core drilling of Raft & Straight section mounting holes

The core drilling of the mounting holes began on June 30th and progressed quite rapidly. The contractor will bring in additional staff to work in separate sections of the ring. After discussing the schedule with the contractor, it is anticipated that the core drilling will be complete ahead of schedule thus allowing the program to advance the next phase of raft support installation

1.9.3 Power Supply System

- The Earthquake Committee approved the AC feeder cable tray support system in Substation 507. Farris Electric has installed the cable tray runs except for a section that penetrates the S507-B118 wall. This section will be installed after the target switchboards are set in place in B118 mid-July.

- The B118 earthquake and cable tray bracing retrofit was completed on June 27th. B118 is now available for AC distribution and power supply installation.

- Change orders were approved to increase the scope of the electrical installation contract to include cleaning the B118 overhead cables and cable trays and to epoxy seal the new concrete floor.

1.9.4 RF System

LLRF and Ancillaries Installation

- The LLRF racks have been installed in the klystron Room 101; the 208VAC is connected and distributed within the rack. The Allen-Bradley system is installed and wired, as is the tuner driver system except the wiring to the cavity. The filament control chassis is installed and wiring completed. The circulator control chassis and klystron focus power supplies are installed and wired. The VXI crate and the IOC and Scanner modules have also been installed. Currently working on the waveguide distribution on top of the bunker and awaiting Air Barriers for the waveguide load installation. The waveguide air system up to the loads is complete and the rest of the air system is being worked on. The klystron water rack is installed and connected to the header. Long haul cables from the RF racks to the cavities will be installed after the waveguide work is complete on top of the bunker.

Klystron Power Supply

- The design of the overhead hoist that will be used to support installation of RF Klystron Power Supply components was approved by the Earthquake and Hoist committees. The hoist was satisfactorily installed and is in service.

- Pulling and terminating of cables that interconnect power supply components is complete with the exception of a small section of 12kV cable and its wire-way. This work will be completed after klystron power supply components are installed.

- A successful design review was held for the stairway that will facilitate safe maintenance of the new klystron power supply and the archived VVT power supply. The reviewers included representatives from the Electrical Safety Committee, Earthquake Safety Committee and ES&H. Purchase and installation of the stairway was recommended by the reviewers.

- Drawings have been completed and a purchase requisition written for the transformer oil secondary containment.

- Work has begun on the klystron power supply Equipment Lockout Procedure (ELP) and commissioning test procedure.

1.9.6 Cable Installation

- The Phase 2 Cable Plant Bid Package design was completed with submission to Contract Services at SLAC. The drawings and specifications wer reviewed by CS and with minor revisions were accepted and distributed to potential bidders on 6/13. We await the bidder's responses scheduled for opening 7/8/03.

- Purchasing of material (tray, cable and connectors) not otherwise procured last year is being purchased this month from SLAC stores and from external vendors as necessary. A large majority of connectors are SLAC store items whereas cable is mainly by external orders.

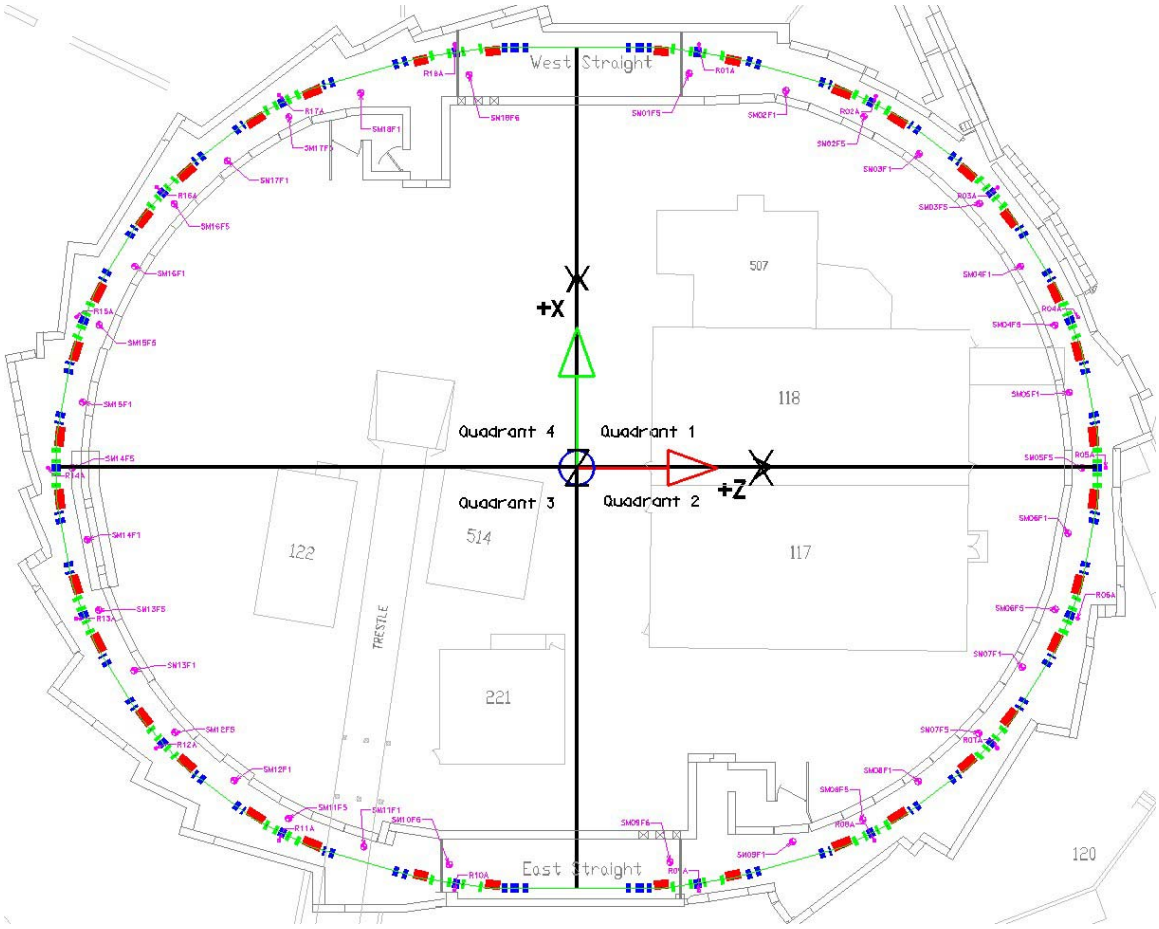
- Contract labor hired for special high-quality cable pre-terminations, e.g. BPMs, have begun work in earnest now that material and source data have converged.

1.9.8 Facilities

The completion of the concrete floor in the SPEAR ring was accomplished 6 days ahead of schedule (June 17) and the project was able to advance to the next phase and begin installation of the new survey monument network. The major portion of the concrete floor was within the plus or minus 3/16" height tolerance. The few areas that were out of specification were reviewed and deemed to be acceptable with the accelerator components that are to be installed. Congratulations are in order to the SSRL Facilities group and W.P. Young, the concrete contractor.

2.0.2 Survey and Alignment

- Monumentation.
  - On June 14, the marking of the floor for the new 3D points started in quadrants 2 and 3. The process was to mark the floor, have the mark surveyed for possible rebar, then move the mark along the beam if necessary and finally drill and install the 3D monuments. The installation of leveling rivets will wait for the cable trays. This work was completed on June 19 with 34 new floor monuments.



- The laser tracker survey of all of the ring monuments as well as some of the SSRL monuments started on June 19. Level observations were performed simultaneously on all floor monuments. On June 21, a preliminary set of coordinates were adjusted. Three more days were necessary to decide and gather additional laser tracker sets and precise level observations to control the connection with the existing set of coordinates derived from surveys last summer. This phase was completed on June 25.

- Templates:
  - The marking of the floor for drilling started on June 26. At the end of the month, all the available templates were laid out and color sprayed.

- Ring Activities:
  - Measurements related to concrete floor installation:
    - height of screed rails in quadrants 3, 4 and 1.
    - floor elevation for new poured concrete in all 4 quadrants.
  - Surveyed roof blocks for BTS raft installation.
  - Mapped the plates after being temporarily placed above the painted marks.

- Final alignment of rafts 78, 84 was completed in the Building 750 raft assembly.

- Miscellaneous
  - Building 26: QC all available templates for drilling holes: 10 units for the straight sections, 12 for the cells and 3 for the SLM.
  - IR12: set the 2 dipoles to the 2 quads on the new BTS raft. Mapped support pads.
  - SSRL Vacuum:
    - Fiducialized BL7 and BL4 wiggler chambers.
    - Fiducialized movable masks for BLs 11, 10,6, 9, 7, 4, 5.

- Daily summary report with occasional pictures can be obtained at: http://www-group.slac.stanford.edu/met/Align/Spear3/Spear3.html