Monthly Progress Report

Stanford Synchrotron Radiation Laboratory

May 2003

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A. SPEAR 3 PROJECT SUMMARY

1. Technical Progress

The installation program continues slightly ahead of schedule. Phase 1 (SPEAR 2 removal) was completed May 3 and Phase 2 began. Phase 2 includes a new heavy duty concrete floor for the tunnel and for the power supply building. The floor for the power supply building (118) was completed in mid-May and the final pour for the tunnel floor is projected for early June. A contract has also been awarded for the seismic retrofit of Building 118 and this work is underway.

For the fabrication effort:

- All Vacuum Chambers for the main magnet rafts are complete.
- Assembly and alignment of 47 magnet rafts with vacuum chambers is complete. Eight rafts are in the final stages of assembly and tests.
- Work is continuing on vacuum straight section components.
- All Magnet power supplies are on hand with some final tests in progress.
- All 4 RF cavities have been received. Two have been successfully processed to 850 KV.
- Design and tests are continuing on many I&C system components. Installation of completed units in racks has begun.
- All Beam Line front end components are near completion.

Progress details on the remaining items being fabricated or assembled are described in Section B. Details of the overall Installation effort are given in Section C.

2. Cost Data

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

Table A1
Costs and Obligations
(through April 2003)

	K$	
	Direct	Direct & Indirects
Costs	41,804	47,346
Commitments	2,803	3,644
Total	44,607	50,990

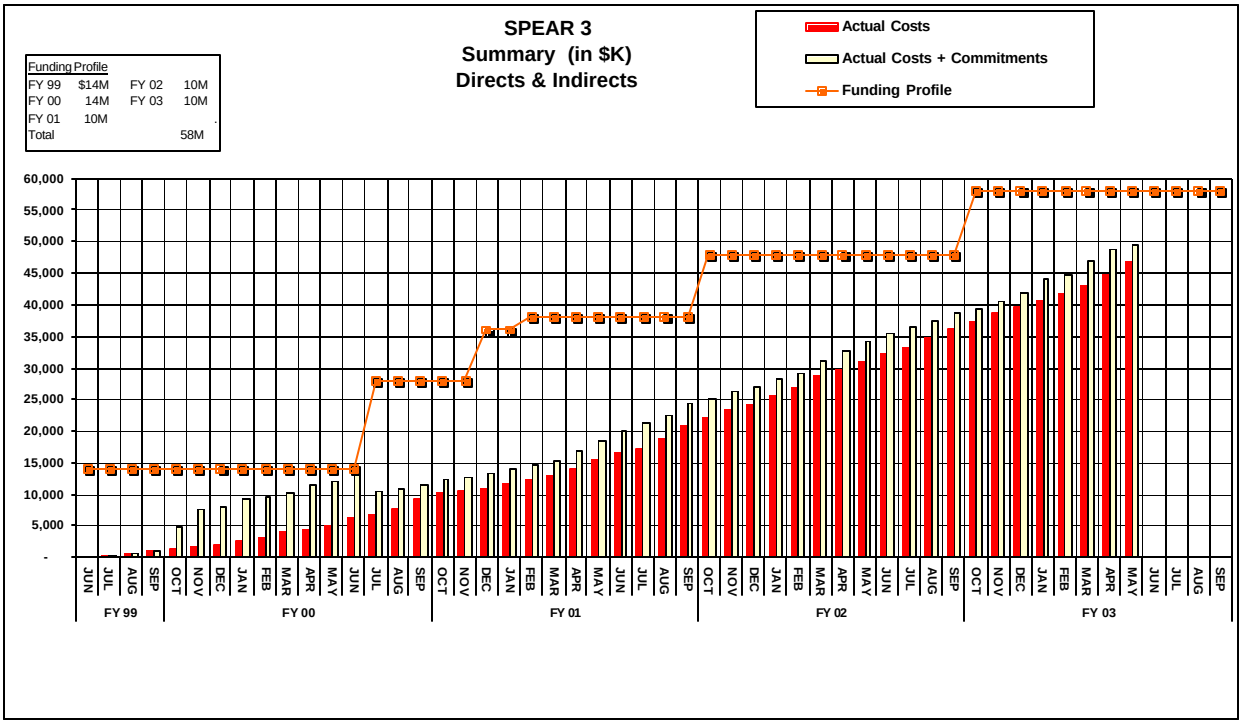


Figure A1

B. Design and Fabrication Reports

1.1 Magnets and Supports

- Magnets and vacuum chambers were installed and aligned on 3 matching cell rafts. LCW and electrical work on those 3 rafts will be done next month. Production of 47 rafts is complete (17 rafts type 50Q, 14 rafts type 145D-T1, 14 rafts 145D-T2, 2 rafts MCS-QT). All the vacuum chambers for the standard and matching cells were received.

- All magnets and vacuum chambers were installed and aligned on the injection beam transport system (BTS) raft. LCW hoses and manifold were connected. Work will continue to finish the LCW system and to align the I-beams that support the BTS raft.

- The magnetic measurements of the injection septum magnet were started. The injected beam integrated transfer function measured with a translating wire showed good agreement with the design parameters and no saturation effects up to 3 GeV were noticed. The first measurement of the integrated leakage field at the stored beam was 40 Gm and it was reduced to 14 Gm after changing the thickness of the mirror plates. Work will continue to further reduce the leakage using shielding material.

1.2 Vacuum System

- Machining started on transition chambers for drift sections.

- Assembly of injection Kickers underway.

- 2-mil window successfully welded to septum chamber. RFI end of June.

- The Personnel Protection Beam stopper brazement redesign completed.

- The PPS beam stopper is partially assembled and awaiting brazement.

- Assembly started on girder, RF, and straight section bellows.

- HOM drift section completed.

- Valve supports completed.

1.3 Magnet Power Supplies

- The magnet power systems were examined as part of a comprehensive SLAC Safety Overview Committee review of all major SPEAR 3 project systems. The committee did not find any significant magnet power systems hazard that had not already been adequately addressed.

- All magnet power supplies have been received except for 12 Intermediate Power Supplies. The delivery of the balance from IE Power will occur by the second week of June in time to support installation. The last twenty MCOR30 bipolar power supplies were received from RiRa. The power supplies will be bench tested even though they have already been factory tested.

- Bench testing of 150 CANDI (Computer analog and digital interface) boards for the bipolar power supplies has begun.

- Testing of the dipole power system in Building 758 is underway. The system has been tested with various load configurations to 300kW, which represents the power limit of the dummy load. Although 300kW is less than half the rated output power of the system, the testing does serve to iron out and resolve other problems that will not have to be faced later. During testing one chopper module developed a water leak. It turns out that the water hose was fabricated with a brass insert instead of a stainless steel insert. The brass insert was split. The chopper module hoses will be replaced with hoses that contain end fittings with the correct stainless steel inserts.

1.4 RF System

Cavities

- Cavity SP3-01 has been successfully RF processed up to 850 kV gap voltage. The cavity Initially suffered from breakdown at the RF window and so could not sustain this high field level. The window was subsequently replaced and RF processing resumed up to full field again, this time without breaking down. Investigations as to why the original window was so unreliable; revealed that the copper plating of the stainless steel ring may have been the cause for facilitating such events. Arc marks were apparent on the copper plated ring, with associated track signatures from the center of the ceramic out to these points on the ring.

- Cavity SP3-02 processed up to 850 KV without incident and utilized an RF window which had an additional 50% Titanium Nitride (TiN) coating of the ceramic window, in order to suppress further the onset of multipactor breakdown.

- Cavity SP3-03 has been baked and is currently having its cooling circuit pipework attached, so that RF processing can start week commencing Monday 9th June 2003.

- Cavity SP3-04 has been shipped from ACCEL and should be in the USA at the time of writing this report.

Klystron

- High power testing of the SLAC build 1.2 MW klystron S/N 03 has been delayed due to problems with the mounting of the output coax assembly. Various components required modification to allow connection of the output transition to the WR2100 waveguide. The DC high-pot tests performed on the tube were successful, revealing no sources for leakage, particularly through the now modified gun ceramic. High power testing of this device will take approximately 4 weeks to complete and is hoped that this will be completed by end June.

- The second SLAC built klystron S/N 04 is approximately 1 month behind S/N 03 in its schedule and testing is hoped to be complete for this tube by end July.

- Following on immediately from the two SLAC built klystrons the two CPI repaired Marconi klystrons will be tested.

LLRF

- The 5 IQA modules for SPEAR 3 have almost completed testing and requires a completed SP3 clock module to conclude testing. The Arc Interlock Modules are completed for SP3. Problem has arisen in the SP3 clock module whereby the Voltage Controlled Crystal Oscillator (VCXO) has significant clock asymmetry resulting in large IQA phase and amplitude noise being generated. Units have been returned to the manufacturer and new VCXO's have been purchased requiring an adapter board to be manufactured.

1.5 Instrumentation and Control Systems

- Work on the computer control system continued with configuring all 70 Bitbus power supply controllers, implementing basic control of the MCOR power supplies, finalizing the Bergoz BPM data acquisition system, and configuring the Ethernet IP interface to the machine protection system. Database set-up continued, including work on the global management of EPICS process variables, history buffers and machine configuration management. Work has begun on specifying operator control panels. The production and testing of MCOR digital controllers continued.

- The automated testing of the 60 4-button-multiplexed BPM processing modules from Bergoz commenced. Interconnection components needed between the BPM processing system are being fabricated and BPM racks ready to be loaded. BPM patch panels and jumper cables are being fabricated. The contract AC power and door installation for the East and West I&C rooms is being prepared.

- The designs of the LO, Clock and Test Tone fan-out units are complete and fabrication of the units has begun. The design of the Tune/Bunch monitor is complete and fabrication will begin in June. The design of the BPM-based current monitor continues.

- 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 progressed. Modifications to the system were identified in a design review held at the end of May.

- The first Orbit Interlock Position Limit Detector chassis has been successfully tested and production of the other 4 units has begun. The design of the central Orbit Interlock Summary chassis is nearing completion.

- The design of the Beam Current Interlock is in progress.

- Installation of I&C equipment into racks has begun.

1.7 Beam Line Front Ends

- All ID fixed masks are QC'd, cleaned, plated, and ready for braze.

- All ID moveable masks have been successfully brazed, welded, and assembled. The masks are in final alignment prior to bake.

- All front end bellows and collimators are either in final assembly, bake, or ready for installation.

1.8 Facilities

For the HCW system, the piping specification package is being prepared for Earthquake Committee approval. The revised schedule is as follows:

- Deliver skid and install – May 28-June 4
- Install electrical and connect – July 21-July 25
- Install Piping to Klystron Bldg. – July 14-July 30
- Install HCW water system – July 21-July 25

C. Installation Reports

1.9.1 Magnets & Supports

- The templates to mark the anchor holes to be drilled on the SPEAR 3 concrete floor were received and their inspection is in progress. The contract for concrete drilling, installation of anchors and grouting of baseplates is being awarded.

1.9.3 Power Supply System

- The new concrete floor for B118 was completed this month ahead of schedule.

- Farris Electric submitted cable tray support design drawings for the cable trays feeders form Substation 507 to two new switchboards that will be installed in B118. One of two cable tray systems has already been installed. The other tray system is scheduled for a mid-June installation.

- The installation of equipment in B118 was scheduled to start on June 17th. However, this date has been delayed to accommodate installation of a supplemental cable tray support structure. A July 1st start date is now envisaged.

1.9.4 RF System

- 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 circular 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 of 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 was 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 bunker.

- A purchase order was written for the overhead hoist that will be needed to support installation of the power supply. Installation will occur in June.

- Work has begun to transfer the 12.47kV feeder from the 8S9 VVT to the new 10S9 power supply.

- Pulling and terminating of cables that interconnect power supply components is about 95% complete.

1.9.6 Cable Plant

- Work in preparation for the installation of the new cableplant system continued to produce the complete and detailed contract package to be released for bid. Interaction continues with SSRL engineering the goal of quantifying cable and connector types and quantities. This is the last precursor to ordering the balance of cable material.

- New identifications of sub-systems requiring long-haul cable plant continue to be submitted by SSRL Engineering for inclusion in the final installation contract scheduled for final editing and printing and for release to vendors for bid preparations on 6/16/03. Scheduled opening of bids is slated for 6/25/03.

- The WBS 1.9.6 Cable Plant Document Package, installation schedule and budget continue to be fine-tuned accordingly, with yet no critical excursions identified at this time.

1.9.7 Beam Line Front Ends

- Because the SPEAR 3 magnet lattice locates the bend magnets in a physically different location, the bend magnet beam lines had to be relocated so as to point towards the appropriate location in the girder chamber contained within the gradient dipole magnet. This relocation was chosen so that the old SPEAR 2 bend magnet beam line crossed the new SPEAR 3 bend magnet beam line at the SPEAR shield wall, commonly described as the "ratchet wall." There are four such beam lines, each with multiple branch lines. Each bend magnet beam line was reviewed by an SSRL beam line engineer who chose the optimal relocation for the centerline. This also included rearranging the fan allocation between the individual branch lines.

- By the middle of May, the out-of-alcove portion of the bend magnet realignment was completed with the exception of the monochromator and mirror tank for BL 1-4. Completion of this awaits the fabrication of a new optical bench for the BL 1-4 mirror. This is not expected to be finished until the end of June. The subsequent alignment of this section should take 1-2 additional days.

- The in-alcove portion of the bend magnet realignment is scheduled for September and October, and will be done in parallel with the alignment of the new beam line "front ends."

- All BL in-alcove hardware is safely cocooned in plywood and plastic enclosure while the SPEAR concrete work progresses.

1.9.8 Facilities

- After the successful removal of SPEAR2 hardware, the contract for installation of the new SPEAR3 ring and B118 concrete floors was begun among other projects. The concrete floor construction was successfully completed for B118 on schedule in mid May as can be seen in the photograph below. The seismic retrofit to B118 has begun in preparation for installation of Power Supplies.

B118 concrete floor

- The tunnel concrete floor is proceeding on schedule and as of the end of May we have ½ of the ring complete with concrete and the second half being prepared for pouring in
- early June. We hope to advance the next phase of the installation schedule if we maintain the current performance.

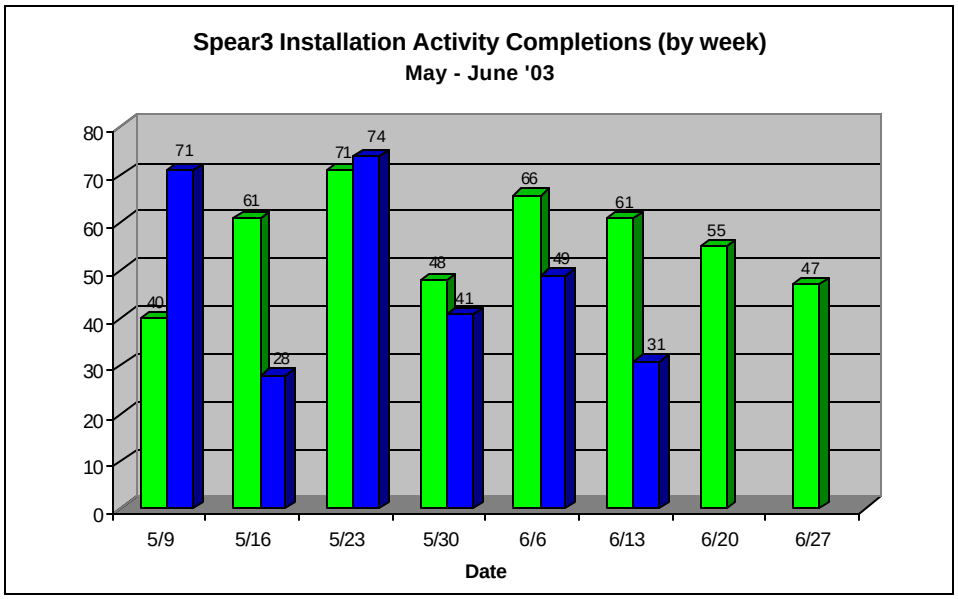
Quadrant 2 with rebar installed and ready to be poured

Quadrant 2 concrete curing in the left photo and uncovered in the photo at right

- The high conductive water system (HCW) pumping skid for the RF circulator and loads was installed in late May, piping runs from the skid to the RF system will occur in late June and early July.

HCW pump skid in place behind B140 at SPEAR

- The overall installation schedule for SPEAR3 is moving along smoothly and on time. Below are some metrics for number of tasks in the project, currently almost 2,500, completed and remaining activities as well as activities completed in May and early June.



	5/9	5/16	5/23	5/30	6/6	6/13	6/20	6/27
Planned	40	61	71	48	66	61	55	47
Actual	71	28	74	41	49	31		
Cum Planned	984	1045	1116	1164	1230	1291	1346	1393
Cum Actual	975	1003	1077	1118	1167	1198	1198	1198

		Inception-to-date			
Group	**Code Value**	**Planned Activities**	**Complete Activities**	**Activities Remaining**	**% Complete**
Links to Pre-Downtime Activities	1	109	77	32	71%
Site Removal	2	941	841	100	89%
Site Installation	3	1369	280	1089	20%
Start Up & Commissioning	4	54	0	54	0%
Total		**2473**	**1198**	**1275**	**48%**

2.0.2 Survey and Alignment

- Realigning bending beamlines (IN1175). The field part of this activity covered the placement of all the components outside alcove for all 4 bending beamlines. It was completed ahead of schedule on May 14.

- Checking flatness of concrete test pad for Tunnel floor. This activity started on April 7 and was completed on May 5. A report of the different phases can be found at: http://metrology.slac.stanford.edu/met/Spear3/PhotoPages/A9-05-05-03.html. More specifically, the computation of the flatness and levelness numbers is given in this report: http://www-group.slac.stanford.edu/met/align/spear3/ASTM_results.pdf.

Ring Activities

- Related to concrete floor installation. Verified the contractor cut points in all quadrants. Checked the height of the screed rails in quadrant 2.

- Set 5 new brass plugs and re-scribed 7 old ones in BL5.

- Surveyed pre-selected points on top of the roof blocks.

Building 750 raft assembly

- Final alignment of rafts 73, 75, 76, 77 and 83.

- Set the alignment plates for the septum and the straight section installation station.

Other

- IR12: set the 2 quads (Q8 and Q9) on the new BTS raft.

- Building 750 pit area: checked the footprints of BL5 and BL10 IDs.

- Building 26: fiducialized one straight section template to debug the procedure and be ready to start the work June 2nd.