Quarterly Progress Report

Stanford Synchrotron Radiation Laboratory

October through December
2002

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A. SPEAR 3 PROJECT SUMMARY

1. Technical Progress

A DOE Lehman Review was held December 4-5, 2002. While a major focus of this review was the up-coming installation plan, general progress in most technical areas was also presented. The Summary Status with General Comments from the review committee report provides a good evaluation of the progress for the period of this report as follows:

Summary Status

"The project has made good progress since the last review July 16-18, 2002. The magnet and power supplies systems have completed most technical equipment fabrication. The vacuum system has resolved issues with chamber production and the completion schedule will meet installation plan requirements. The RF cavities are in production after electroforming issues were resolved with the vendor. Delivery milestones for the four cavities is sufficient for final assembly and checkout. All conventional construction activities have been completed during the past three annual downtimes. Accelerator Physics and Controls system have developed resource loaded schedules to complete critical activities to support SPEAR 3 startup. The installation plan continues to be optimized. The current version of the plan includes additional details with updated activities, resources and costs. ES&H plans are being prepared for the Accelerator Readiness Review and installation activities. The Final Safety Analysis Document will be ready for review early next year."

General Comments

"The SPEAR 3 team has made excellent progress in using the scheduled maintenance periods to perform as much pre-installation activities as possible.

The overall installation plan is sound, however the schedule continues to be aggressive, in particular, the tunnel floor contract.

The magnet raft assembly issues with the vacuum chambers' production are being actively addressed and the impacts associated with availability scenarios have been evaluated.

Good progress has been made in the controls software. The addition of a software engineer and the resource-loaded schedule presented greatly increases the confidence of reaching their stated goals.

The project's ES&H procedures are headed in the right direction."

2. Cost Reporting

The total project costs and commitments through December of this quarter are provided in Table A1. The integrated costs and commitments per month are plotted in Fig. A1.

Table A1
Costs and Obligations
(through December 2002)

	K$	
	Direct	Direct & Indirects
Costs	35,324	39,965
Commitments	2,363	2,505
Total	37,687	42,470

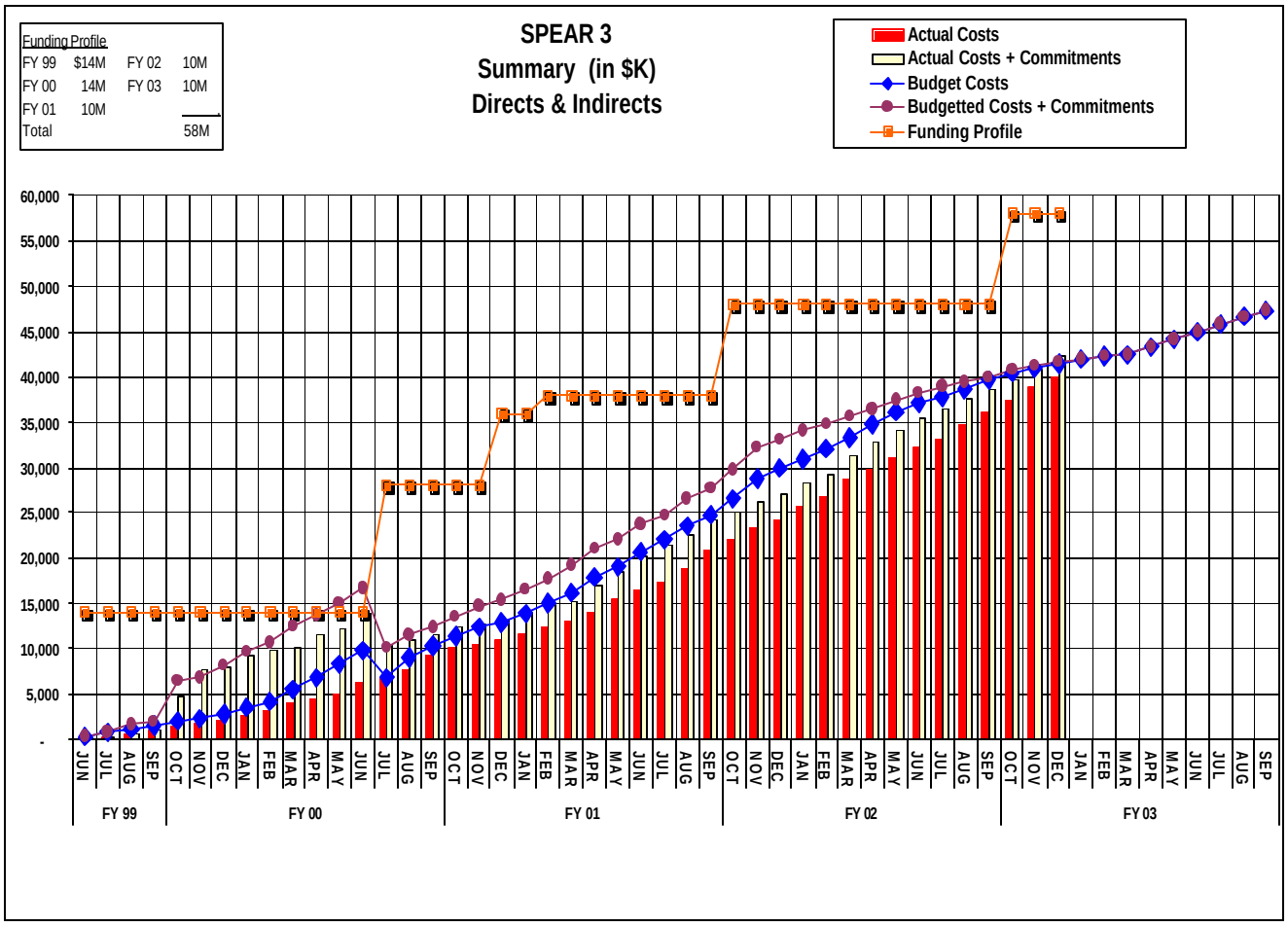


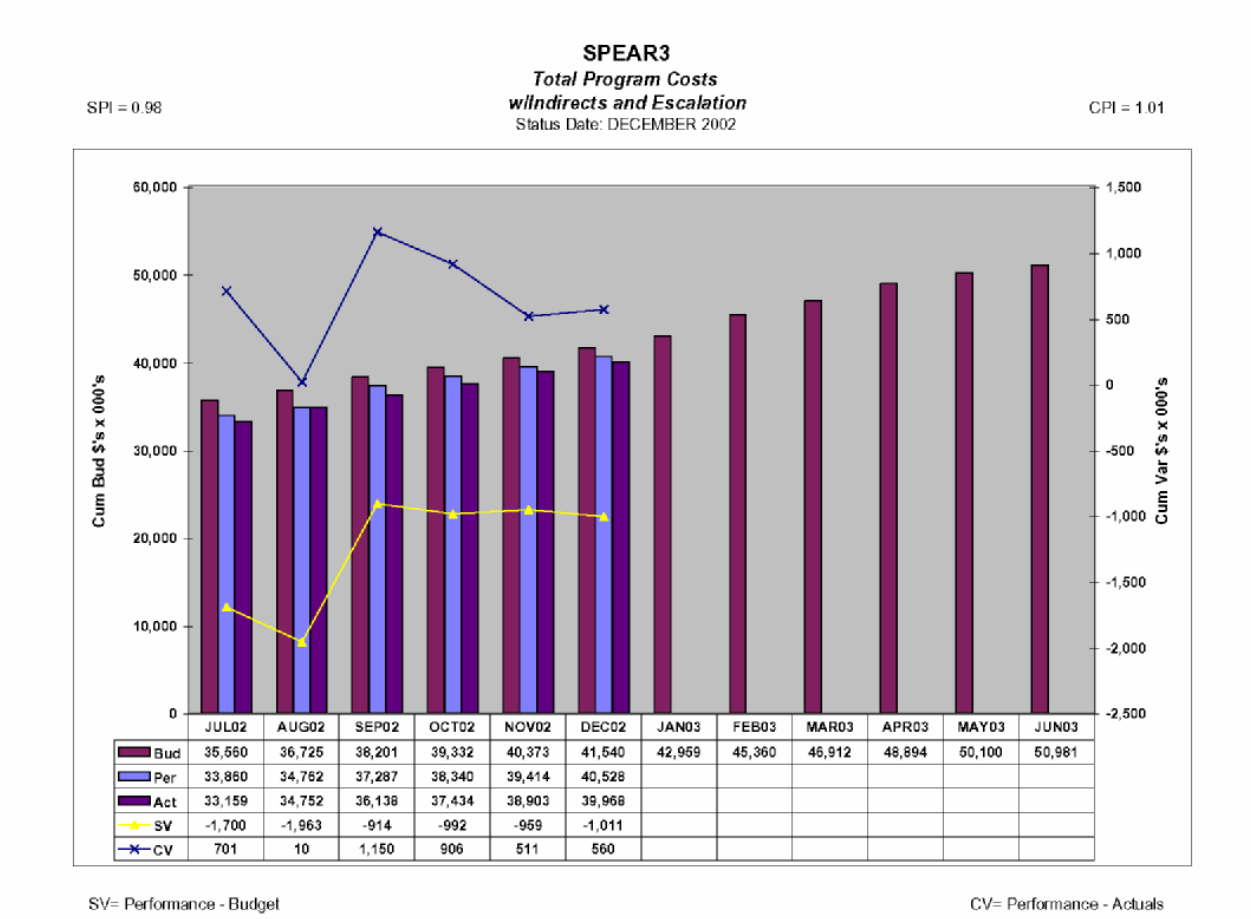
Figure A1

Table A2 provides the project performance data with associated cost and schedule variances at WBS Level 2. The monthly variance record is given in Fig. A2. The negative schedule variance is due primarily to the vacuum system which is still ~ 1 month behind the desired completion date of April 1, 2003; however, the condition has not changed since the last quarter and does not pose a condition for project delay.

Table A2

Cost/Schedule Status Report				
	Contract Type/No:	Project Name/No: SPEAR3 Project - rev. A ($58M)	Report Period: 11/30/2002 12/31/2002	Signature: Title/Date: 1/30/2003
(1) Original Contract Target Cost	(2) Negotiated Contract Changes	(3) Current Target Cost (1) + (2)	(4) Estimated Cost of Authorized Unpriced Work 0	(5) Contract Budget Base (3) + (4) 57,995

Performance Data								
	Cumulative to Date					At Completion		
WBS[2]	Budgeted Cost		Actual Cost	Variance				
	Work Scheduled	Work Performed	Work Performed	Schedule	Cost	Budgeted	Latest Revised Estimate	Variance
1.1 Magnets and Supports	8,636	8,531	8,299	-105	232	9,149	9,181	-32
1.2 Vacuum System	9,684	9,028	8,880	-655	148	13,279	12,353	926
1.3 Power Supply System	3,024	2,961	2,249	-63	712	3,514	3,182	331
1.4 RF System	3,921	3,856	3,894	-65	-38	4,624	4,692	-68
1.5 Instruments Control & Protection Systems	2,461	2,353	2,529	-107	-175	3,633	3,917	-284
1.6 Cable Plant	1,810	1,737	1,765	-72	-28	2,597	2,483	113
1.7 Beamline Front Ends	757	724	709	-33	15	1,056	1,003	53
1.8 Facilities	3,229	3,319	3,215	90	105	3,509	3,897	-387
1.9 Installation and Alignment	0	0	158	0	-158	3,224	5,165	-1,941
1.0 Mgmt, Support, & Accelerator Physics	3,173	3,173	3,529	0	-357	4,037	4,034	3
Gen. and Admin.	4,845	4,845	4,741	0	104	5,974	6,248	-274
Undist. Budget						0	0	0
Sub Total	41,540	40,528	39,968	-1,011	560	54,597	56,156	-1,559
Management Resv.						3,398	1,839	1,559
Total	41,540	40,528	39,968	-1,011	560	57,995	57,995	0



	JUL02	AUG02	SEP02	OCT02	NOV02	DEC02	JAN03	FEB03	MAR03	APR03	MAY03	JUN03
Bud	35,560	36,725	38,201	39,332	40,373	41,540	42,959	45,360	46,912	48,894	50,100	50,981
Per	33,860	34,762	37,287	38,340	39,414	40,528						
Act	33,159	34,752	36,138	37,434	38,903	39,968						
SV	-1,700	-1,963	-914	-992	-959	-1,011						
CV	701	10	1,150	906	511	560						

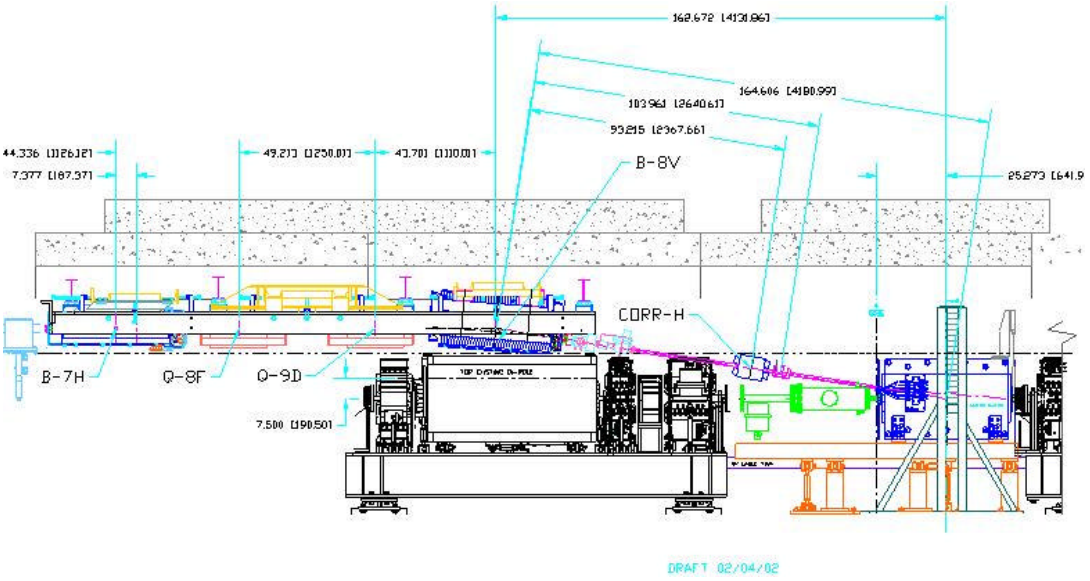
Figure A2

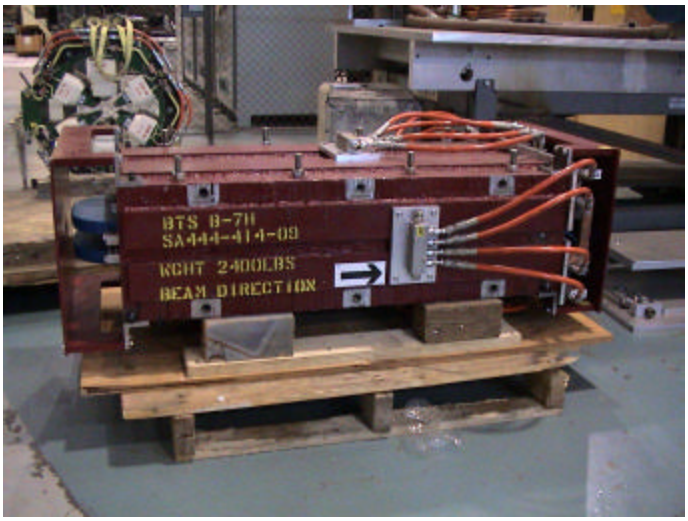
B. Detailed Reports

1.1 Magnets and Supports

Beam Transport System (BTS) Magnets

The quadrupole magnets Q8 and Q9 have been measured magnetically. The assembly of the dipole magnets B7H and B8V has been completed and the magnetic measurements will be performed in January. The septum magnet final design review was done in November and the magnet is in fabrication. A sample of the Carpenter B-FM high permeability iron used in the septum magnet was heat treated in hydrogen atmosphere at SLAC to enhance its magnetic properties and the magnetic measurements have confirmed very well the high permeability data provided by the manufacturer.



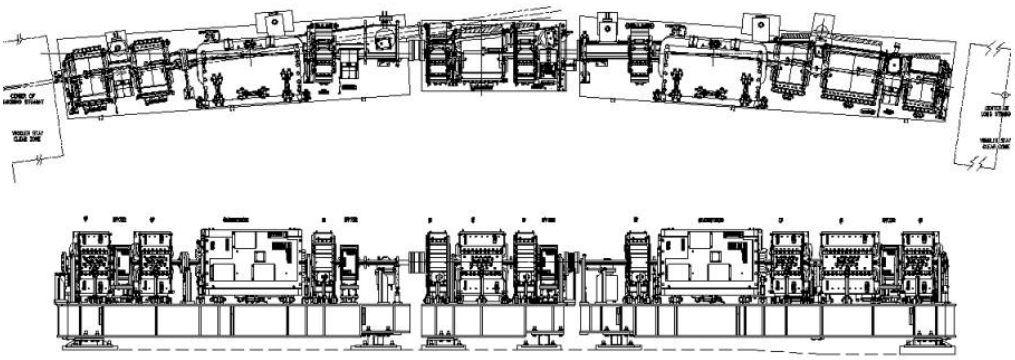


B7H Magnet

Magnetic measurement of the B8V magnet

Supports System & Assembly

The 8 Matching cell rafts have been delivered to SLAC. All the raft base plates are in fabrication and will be ready by early February. The raft base plates have predrilled alignment holes and will be aligned and grouted without requiring precision drilling in the SPEAR 3 tunnel.



LCW Systems

The LCW headers for the standard cell girders were received and modified by the manufacturer to meet geometrical tolerances. In the next quarter these ~30' long headers will be pre-assembled onto their supports and have valves installed. Upon completion of pre-assembly these 16 units will be placed in storage until installation in the ring.

Raft assembly

Production assembly of the rafts is proceeding: 17 of the 18 type 50Q rafts and all of the 14 type 2 145D rafts are finished this quarter. The first unbaked BM2 chamber was test fitted on a 145D-Type 1 raft. The raft supports for the 4 matching cell rafts have been aligned and grouted in bldg. 750 using the same technique that will be used in the SPEAR tunnel.

1.2 Vacuum System

The engineering efforts and manufacturing milestones during the past quarter include the following,

- Completed the assembly, welding and vacuum processing of the standard BM1 chambers.
- Completed the assembly and welding of the standard BM-2 chambers.
- Started the assembly and welding of the matching chambers.
- Started the assembly of the septum chamber.
- Fabricating the piece parts for the injection chambers.
- Completed the final design review for the RF straight chambers.
- Fabricating the piece parts for the RF bellows.
- Completing the piece part drawings for the RF straight chambers.
- Completed a prototype straight section elliptical tube.
- Completed the final design of the QFC beam dump chamber.
- Fabricating the PPS stopper chambers.
- Fabricating straight section rafts.
- Completing the detail drawings for the DCCT and Injection drift and transition chambers.

Standard Girder Chambers

BM-1 & BM-2 Standard Chambers
The BM-1 chamber EB welding and assembly was completed this past quarter and the remaining three chambers were baked. The chambers have been installed onto their rafts.

The BM-2 chamber welding and assembly was completed this quarter except for one chamber which is on engineering hold due to a leak in the BPM. One oven was modified to bake four BM-2 chambers at a time. The other bake out oven is reserved for the matching chambers. The bake out of the BM-2 chambers should be complete by February.

Matching BM-1 and BM-2 Chambers

The short boxes for the matching chambers were welded this quarter and the MCA BM-1 chambers were also completed. However, a leak in the V4 chamber attached to the BM-1 chamber was discovered. The material used for the side walls were determined to be unsatisfactory for vacuum use. This material was used by SLAC's Mechanical Fabrication Group and was purchased certified from SLAC Stores. To minimize the impact to the matching chamber schedule, the V4 chamber was redesigned to reduce re-machine time of the plates. The TSP port was moved into the adjacent downstream straight drift chamber and the masking reduced. The new V4 box plates are expected by the end of January. The MCA BM-2 boxes are being fabricated this quarter. The MCB plates arrived in January and the expected assembly finish of the remaining matching chambers is the beginning of April.

Figure 1: MCA BM1 Top and Bottom Plates

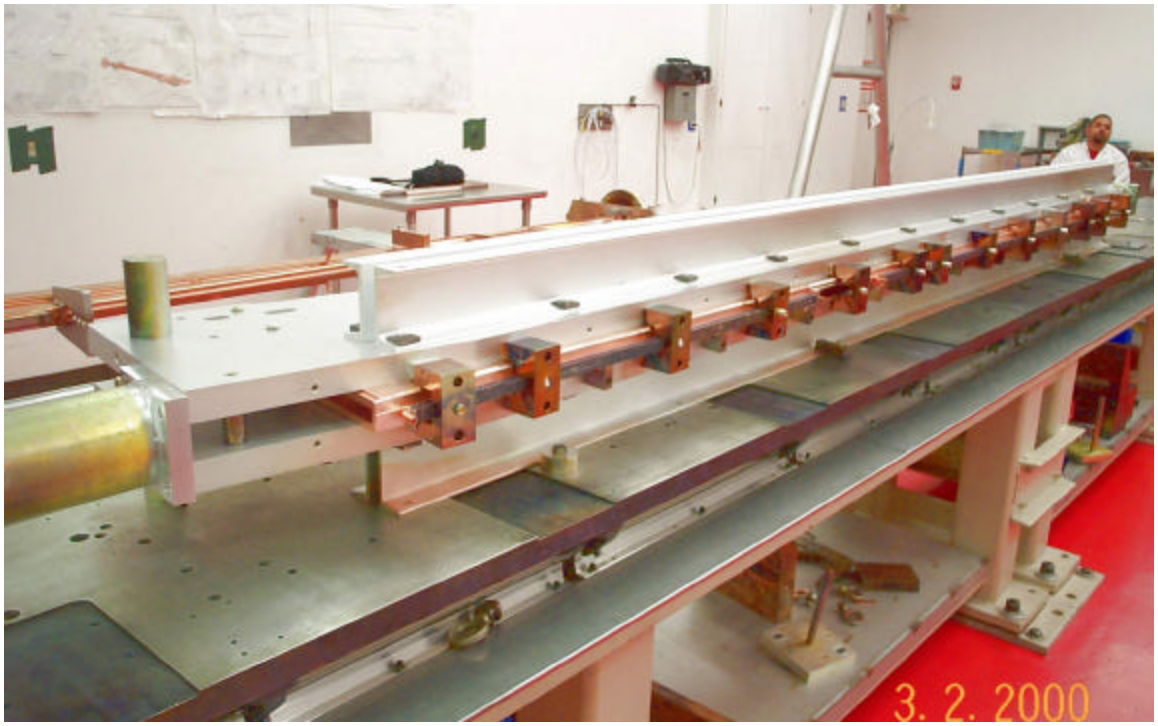


Figure 2: MCA BM1 Box with Cooling Line Weld Set-up

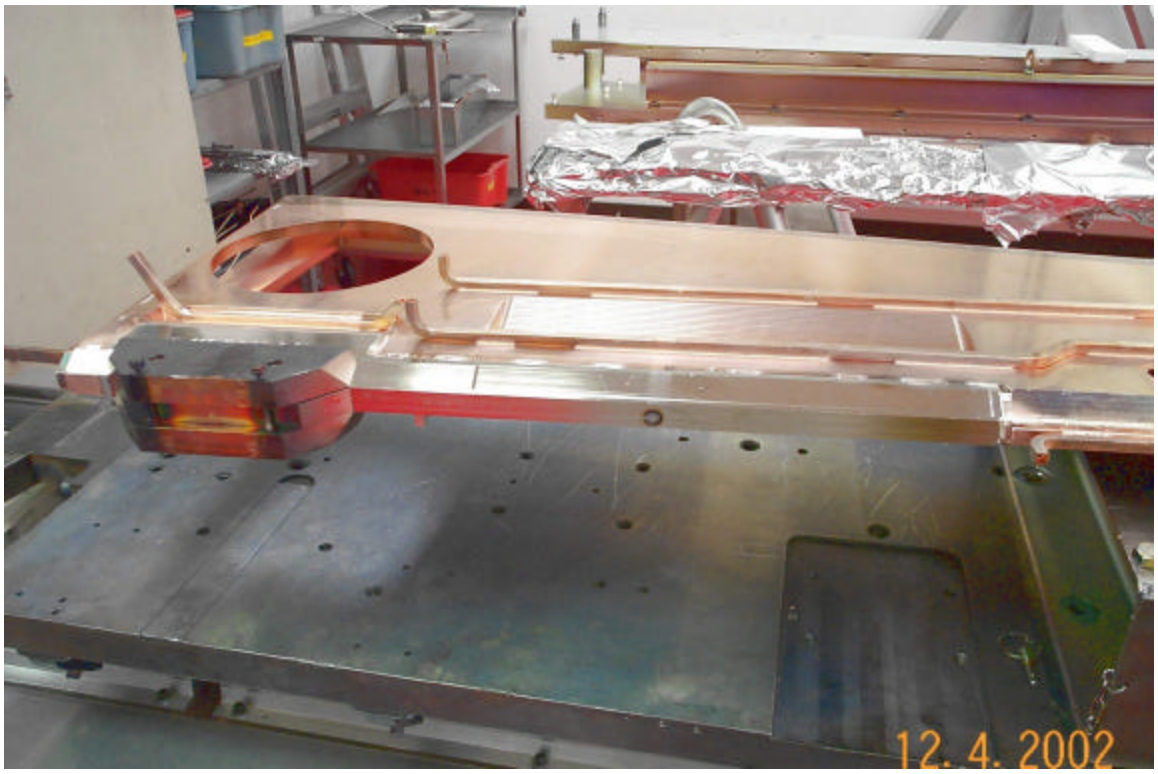


Figure 3: MCA BM1, Eddy Break Long Weld

Figure 4: MCA BM2 Chamber Fiducialization

Figure 5: MCA BM2-1 and BM2-2 Alignment

Diagnostics

- PPS Stoppers – piece part drawings were ordered this quarter.
- DCCT – Detail drawings near completion.

Straight Section

- Straight section rafts ordered.
- Prototype elliptical tube produced and met design requirements.
- Final design review for the RF straight section chambers was successfully held this quarter. Detail drawings are being completed and parts for the HOM drift, RF transitions, and RF drift should be on order by February. Long lead items were ordered and received.
- The final design review for the RF bellows was successfully held this quarter. Detail drawings were released and part fabrication is underway. The bellows should be complete by April.

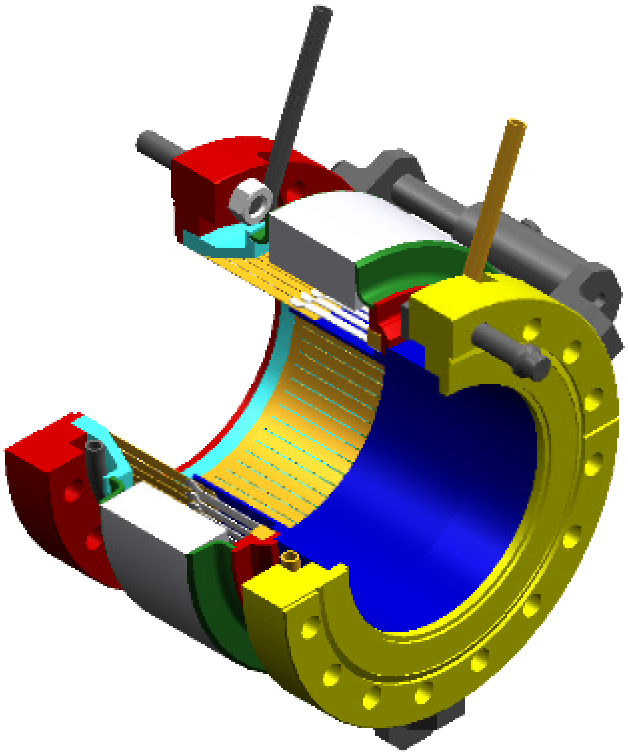


Figure 6: RF Bellows

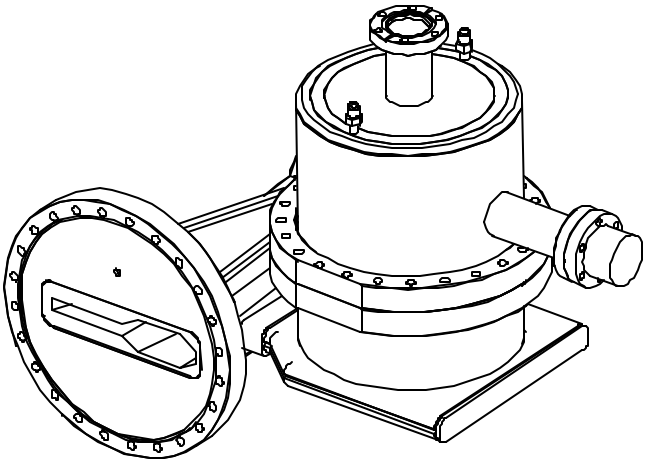


Figure 7: RF Straight – Transition/TSP Pumping Chamber

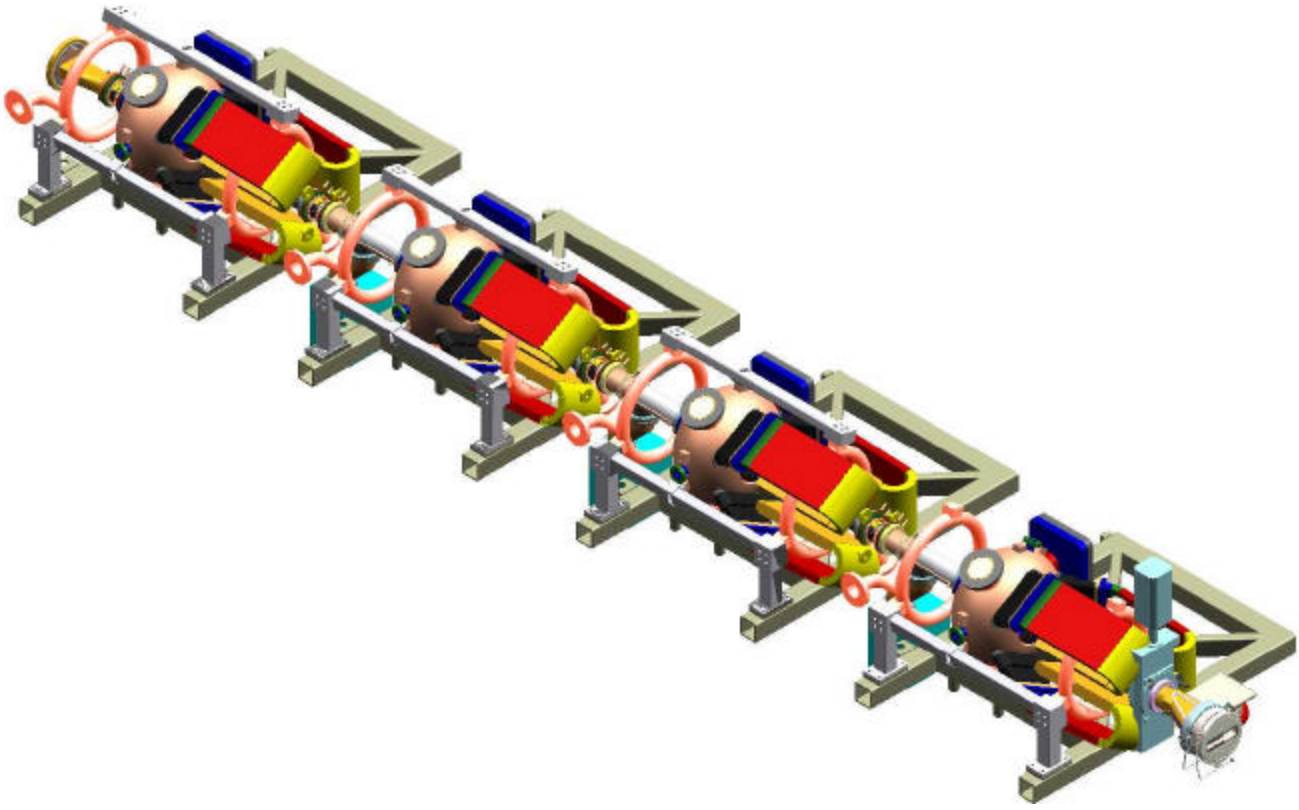


Figure 8: RF Straight Layout

1.3 Magnet Power Supplies

Summary

All magnet power supplies are in fabrication or have been fabricated. Those power supplies that are on-site have been bench tested. Power supply rack assembly and wiring is about 85% complete. The design of the AC Distribution system was completed and most of the expensive, long-lead items have been received. B118 refurbishment plans have been completed for inclusion into a request for proposal a fixed price contract.

Unipolar Power Supplies

Dipole Bulk Power Supply

The Dipole Bulk Power Supply cabinet structural drawings were approved by the seismic analysis group. Alpha Scientific was subsequently authorized to fabricate the 1500V, 800A, 1200kVA Dipole Bulk Power Supply. SLAC power conversion personnel have made several trips to Alpha Scientific to monitor fabrication, which is about 90% complete. The present schedule calls for testing the bulk power supply the 3rd week in January. Since Alpha's facility and load are power limited, the bulk power supply will be tested at a power level considerably below its 1200kVA rating. However, when it arrives at SLAC the bulk power supply will be tested by the Power Conversion Department at substantial power levels.

Dipole Chopper Modules

All 6 chopper modules (4 operating and 2 spares) have been fabricated, bench tested and assembled in the chopper module double-bay rack by Power Conversion personnel. The chopper module rack assembly is progressing well. When the rack assembly is complete the chopper modules will be tested with a small bulk power supply (or possibly with the Alpha Scientific Bulk Power Supply) to ensure that all 4 modules operate as an integrated system. Below is a photograph of the chopper module rack showing the 4 chopper modules, 2 chopper module controllers, BitBus controller and Danfysik current monitoring transductor electronic chassis.

Dipole Chopper Module Rack

Large Power Supplies

IE Power delivered the 6 large (approximately 130kW) power supplies that will power the QD, QF, QFC, QFC, SD and SF magnet strings. All of the 6 power supplies have been tested on-site. Several modifications were made to all 6 power supplies in order to enhance their performance, including:

- The addition of common-mode noise suppression circuits on both the input and output
- Replacement of the voltage feedback amplifier to improve output stability
- Replacement of key lockable emergency off buttons with non-key-lockable buttons
- Adding RC damping networks to the low-frequency input filter for better transient response

Below is front view photograph of three of the six large power supplies and a rear view of two of the power supplies.

Large Power Supplies

Intermediate Power Supplies

IE Power has fabricated and assembled two 2.5kW prototypes and these are in test. All parts for the other 78 power supplies are on hand. After successful prototype test completion, the power supplies will be assembled and tested. All power supplies are scheduled to be on-site by the middle of March..

Below is a photograph of an intermediate power supply rack lineup. The racks have been wired and are awaiting the arrival of the power supplies from IE Power.

Intermediate Power Supply rack Line-up

Bipolar Power Supplies

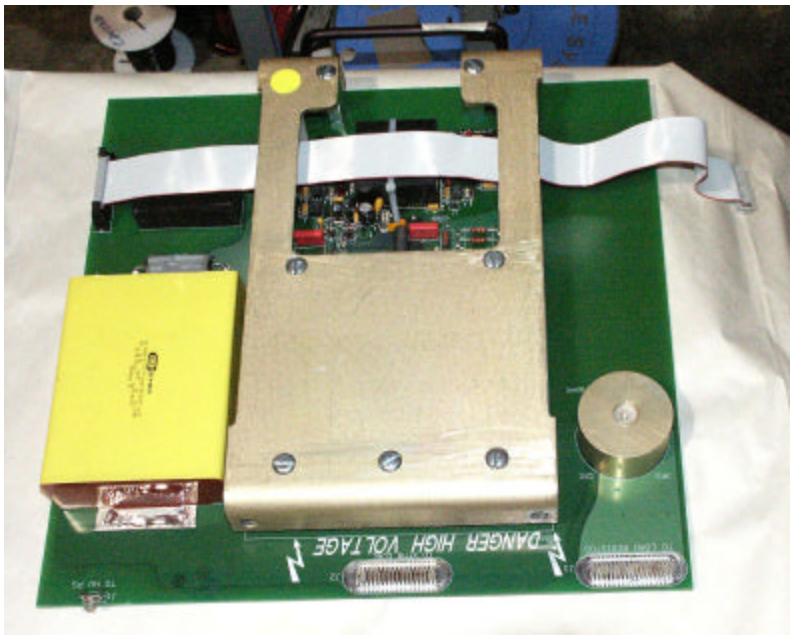
All 150 bipolar power supplies, used for the correctors, QMS trims and insertion device trims, have been assembled into racks and wired. The QMS switching chassis have been assembled and will be installed into their racks during the next reporting period. Below is a photograph of a line-up of bipolar power supplies installed in the racks.

Bipolar Power Supply Racks – Front and Rear Views

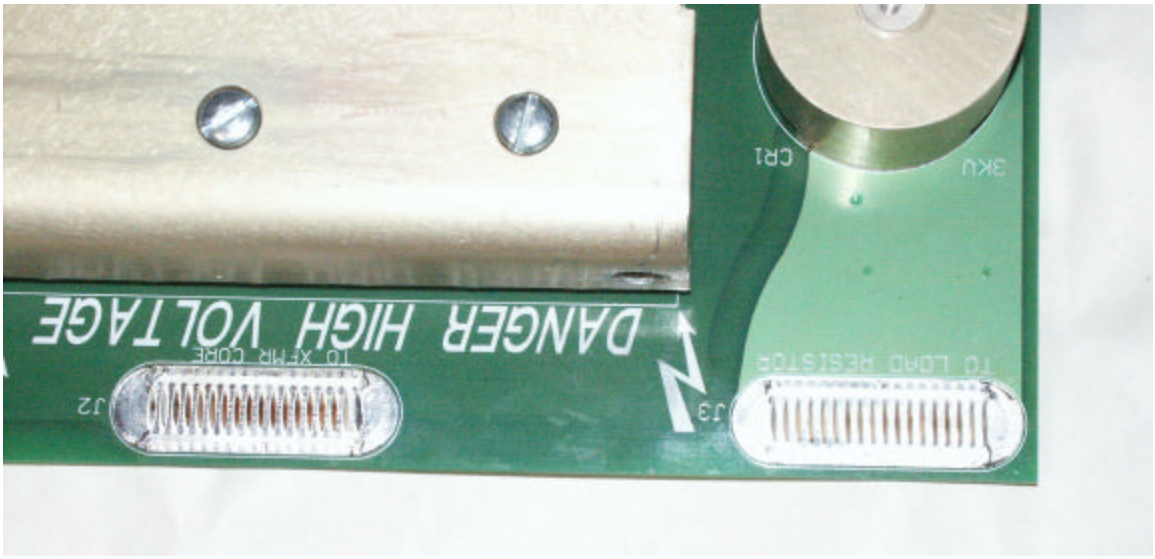
Pulsed Power Supplies

Kicker Pulsers

The K1, K2 and K3 pulsers have been assembled and tested. All three systems have undergone extensive interlock, control and power testing with the refurbished prototype kicker magnet. The prolonged period of testing revealed a weakness in the design of the finger-stock that is used to connect the IGBT driver boards to the pulse transformer primary windings. A new type of finger-stock has been ordered from Etch-Tech and it will be tried in an attempt to cure the arcing with the present parts.



A Typical Pulser IGBT Board



A Blowup of the Two Offending Finger-stock

Racks

Assembly and wiring of the SPEAR 3 racks is about 85% complete. The bulk of the remaining work involves the mounting and wiring of 80 intermediate power supplies.

AC Power Distribution

The following equipment was received and is in storage on-site:

- Two 4000A switchboards
- Five 480V motor control centers
- Three 480V:208V/120V distribution transformers
- Five 480V:208V/120V power distribution and lighting panel-boards
- 2,500 feet of 1000kcmil cable that will be used to connect the switchgear in Substation 507 to the two purchased 4000A switchboards that will be installed in B118.

Five 480V motor control centers are due from Cutler-Hammer by the middle of February.

In addition, the Building 118 lighting design was finalized. The design includes overhead, exit and emergency lighting. The overhead lighting consists of three circuits; a non-switched circuit where a portion of the overhead lights are always on, and two switched circuits that share the balance of the overhead lights. So, a few lights are always left on to avoid a stumble hazard, or 50% can be turned on or 100% can be turned on. The exit lights and emergency lights are not switched and always remain on. A purchase requisition has been issued to purchase the lights.

Building 118 Refurbishment

Refurbishment Planning

Planning for the refurbishment of B118 included a peripatetic investigation of the AC feeds to B118 electrical equipment. The fruits of the walk-around included updates of the B118 layout drawing and the SPEAR one-line diagram. These documents will be used in preparing the lock-down procedure that will be needed to safely start of the B118 demolition.

A B118 equipment removal drawing was generated to show the electrical racks, cabinet, power supplies, raceways and other equipment that will be removed as well as showing those that will stay. A demolition/decommissioning specification was also written.

A specification was written for installation of new electrical equipment in B118.

The above documents form an important part of a request for proposal (RFP) that will be issued to obtain a fixed price contract to decommission the existing electrical equipment in B118 and to install new AC Distribution equipment, power supplies and lighting. The RFP will be issued during the next reporting period.

1.4 RF System

Cavities

The RF Cavities being fabricated at ACCEL INSTR. in Germany have experienced delays due to electro-forming problems. The new electro-forming process has been proven successful and two of the four cavities have finished the forming process as of early January 2003.

The revised delivery schedule of January through March 2003 still stands and is being closely watched by phone conference every two weeks. The schedule leaves sufficient time to assemble and test the cavities before installation in Aug. 2003.

Klystron High Voltage Power Supply

The HVPS for the SPEAR 3 klystron was moved into its final location, which was a challenge because of the 46,500 lbs weight of the device (see picture below).

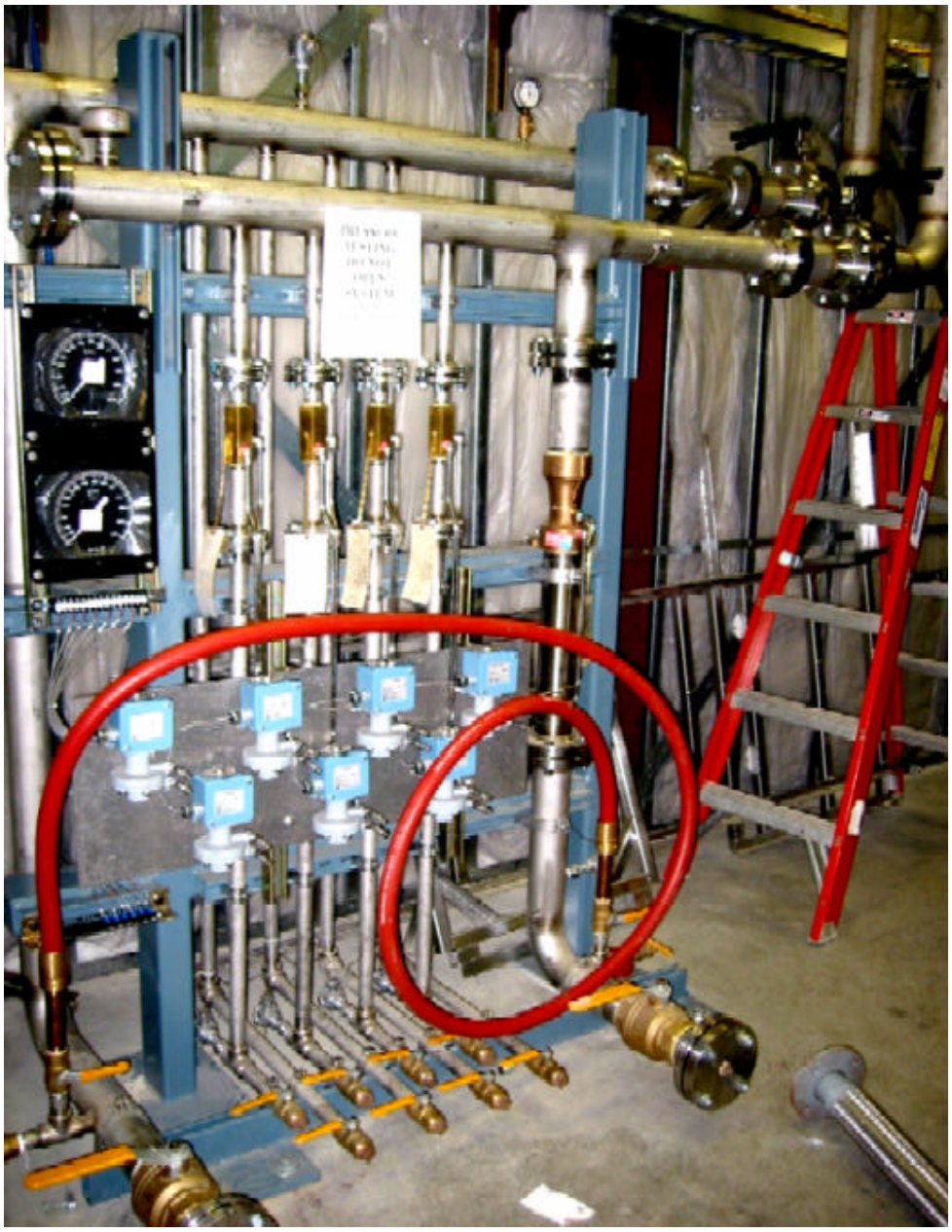
Low-level RF

The Low-level RF System prototype modules are complete at the Electronics & Software Engineering Department at SLAC. The final modules are in fabrication. Completion is expected by February 2003.
Work on software changes for SPEAR 3 has made good progress.

The control racks have been installed with most of the auxiliary chassis in place (see picture below). Interconnecting wiring is being installed at the time of this report. Cable trays between control racks and the SPEAR 3 tunnel have been installed.

Water Distribution Rack

The Water Rack for klystron and circulator cooling has been installed in the klystron building, Rm 132. It has been connected to the Low Conductivity Water system and water will be circulating through the red temporary jumper pipe (see picture below).



1.5 Instrumentation and Control Systems

Work on the computer control system progressed with the successful implementation of several EPICS IOCs and the testing of various data acquisition components. In addition, an experienced EPICS programmer was hired. The hardware design of the digital control components for the corrector power supplies was completed and final programming is in progress. Commercial BPM processing units are being tested and the data acquisition system is being configured. The injector RF and timing controller was completed and the design of the computer-interfaced controller has begun. Detailed design of the Orbit Interlock, Beam Current Interlock, and other protection systems is in progress. Work on I&C interconnection diagrams continues, and rack profiles have been completed.

Computer Control System

An experienced EPICS programmer, having years of experience working in the SLAC accelerator controls group, was hired and consequently relieved the concern about manpower limitations expressed at the August 02 software design review. The software development group is making substantial progress in implementing EPICS IOCs using the open RTEMS real-time operating system (in place of proprietary VxWorks), configuring the control system infrastructure and control database, and establishing operation of data acquisition and control interface modules.

All components of the fast, 8-channel corrector power supply controller have been designed and are in various stages of production. Data processing firmware for the components will be finalized in the next quarter. Development of software for fast (4 kHz) control is in progress.

Testing of the triggerable 8-channel, 16-bit ADC IP module selected for precision BPM signal digitization is in progress and a design modification change order has been submitted to the vendor. Other multi-channel input and output interface modules have been specified; digital input modules for the Orbit Interlock and output modules for the QMS and TSP switchyards have been procured and are being tested.

Detailed interconnection diagrams for the computer control system are in production.

Beam Monitoring Systems

Testing of the 60 4-button-multiplexed BPM processing modules from Bergoz is in progress. Related crates were received from Bergoz, Inc. The design of interconnection components needed between the BPM processing system and the VME data acquisition is complete and component purchasing has begun. The specification of BPM long-haul cables is complete; the specifications for jumper cables will be completed in the next quarter. Equipment racks for the BPM system have been ordered and will be received in the next quarter

Tune monitor, synchrotron light monitor instrumentation, and injection monitor control designs are in progress.

Detailed interconnection diagrams for all beam-monitoring systems will be completed in the next quarter.

Quadrupole Modulation System

The Quadrupole Modulation System switchyard will be controlled by CAMAC digital interface components. Design of QMS was assigned to an engineer within the SLAC Power Conversion Group and fabrication is complete.

Timing System

The RF/Timing Signal Generator system from Wenzel was received and is being tested Fabrication of the Booster RF Signal Generator and phase shifting unit is complete. The design of the Injection Timing Controller, which communicates with the Booster RF Signal Generator, has begun, but delivery of this unit is not expected until March 2003.

Protection Systems

Detailed configuration of the programmable logic controller systems for the vacuum and magnet water protection interlocks is in progress. Ion pump power supplies have been ordered and purchase requisitions for ion gauge controllers are progressing. Interconnection diagrams for machine protection components are in production.

The detailed design of the Orbit Interlock Position Limit Detector was completed and component procurement has begun. The design of the central Orbit Interlock Summary chassis is in progress. Computer interface modules have been selected.

The design of the Beam Current Interlock that prevents beam lines not rated for high current operation from being opened above specified beam current levels is in progress. The use of this and other beam containment components, including Average Current Monitors and Long Ion Chambers, will be reviewed by the SLAC Radiation Safety Committee in the next quarter.

1.6 Cable Plant

The Cables phase 1 contract which includes the majority of the long haul cables for the project plus the East Cable trays and South Ring trays is 95% complete. The majority of cables have been installed with work currently proceeding on the Injection Kicker cables and HV cables for the RF system.

East Straight Canopy- A bid package was sent out on October 9th. The design and analysis of the canopy for the penetration of the future cable tray in Building 116 (east pit) is complete. The design produced several drawings that were reviewed and approved by management and will be used in obtaining fabrication and installation bids. SLAC Earthquake Committee also approved it on 10/4/02. The canopy was completely installed in November before the rains.

Follow up on cable purchasing for the Cables phase 1 installation continues with the purchase of additional cables as required to finish the installation. Cables have been released to the contractor as required when requested and signed for.

The final design of the ring tray drops is also 95% done. The design of the isle-side tray supports has been completed.

A detail review and update of the cable plant installation schedule for 2002-2003 has also taken place.

An update of rack profiles and EI's (Electrical Interconnect Drawings) for DC power supplies conforming with the present layout was made.

Cable lugs for DC cables have been received and stored.

The start of CAPTAR coding and the finishing of EI drawings for phase 2 cable contract is building up momentum as Engineering details are submitted by SSRL staff.

1.7 Beam Line Front Ends

In the past three months all the remaining front end component detailed designs have been released and fabrication of these remaining items has commenced. The assembly of the injection stoppers is complete. The final assembly of the bend beam line front end masks, which has been slowed owing to a vacuum leak in the final braze step, is scheduled for completion in early February. Six of the seven ID moveable masks are either complete or in final assembly. The remaining ID moveable is still in fabrication. One of the ID fixed masks is complete with all six of the remaining ID fixed masks in fabrication. Two of these masks are close to critical path though recent progress by the EDM vendor indicates the fabrication schedule is conservative.

Detailed planning of SPEAR 2 front end removal and SPEAR 3 front end installation has also progressed substantially in the past few months. Finally, the detailed analysis and planning for the bend beam line realignment, which is required owing to the relocation of the SPEAR 3 bend beam line source points, is well along.

1.8 Facilities

Most of the conventional Facilities work for SPEAR 3 has been completed as planned during the normal shutdown periods of the last three years. The work completed in this year's shutdown included:

- A new reinforced concrete roof over the East Pit
- A new shielding wall from the East Pit toward the Trestle
- Cast-in-place removable roof blocks in the Transition areas
- A new AC power distribution system for the ring
- New lighting and fire-alarm systems for the ring

This work was completed on October 2, 2002, two days ahead of the scheduled completion date.

Planning and design efforts have been underway for the construction of a new 18" reinforced concrete floor in the SPEAR tunnel as well as a new 8" reinforced concrete floor for the Building 118 Power Supply building. The work will include excavation and removal of existing asphalt, concrete and soil, site preparation, surveying, installation of protection slabs, installation of grounding wire, installation of steel reinforcements, and installation of concrete. The estimated total amount of asphalt, concrete and soil removal is 700 cubic yards. The estimated total of new concrete installation is 450 cubic yards.

The construction performance period of this effort is from May 7, 2003 to June 24, 2003.

1.9 Installation

Progress has been made on the installation plan for SPEAR 3 over the past quarter. A DOE review was held in July 2002 with an overall positive outlook from the reviewers. The DOE reviewers commented that "The overall installation plan is sound, however the schedule continues to be aggressive,…" and the SPEAR 3 team concurs with their assessment. We continue to develop the installation plan by meeting regularly with the project coordinators and revising the overall schedule.

Since the last review the project worked on various scenarios to enhance our ability to plan the phases of the installation. One such scenario is to make the SPEAR ring cable plant removal portion part of the magnet & girder removal contract, thereby eliminating a potential interference between contractors in the limited tunnel confines. Further we concluded that removal of the raft supports from the magnet & girder removal contract would allow a more definitive beginning of the installation phase of this contract. The raft and straight sections supports will be installed after appropriate survey and alignment is complete by the SLAC Metrology team and will be done using T&M contract labor.

The project teams will continue to work on areas of the removal and installation portions of the schedule to ensure all aspects of the work are included.

With respect to the major contracts for the installation of SPEAR 3, we are well along on completion of specifications for these 6 contracts as can be seen from the attached chart.

CONTRACTS		SPECS TO PURCHASING FOR APPROVAL (2WKS)	OUT TO BIDS	WALK THRU	OPEN BIDS	AWARD/KICK-OFF MTG.	START
UTR = UTR/ Project Manager							
1 Rigging ($ 850k)	UTR= Brad Youngman/ Ben Scott Phase 1 - S2 Remove Phase 2 - S3 Install	1/20/03	1/28/03	2/3/03 2/10/03	2/18/03	2/20/2003 award 2/27/2003 k/o mtg Rigging Plan due 03/10/2003	3/25/2003 MOBILIZED 4/7/03 start phase 1 7/18/03 start phase 2
2 Concrete Floor	UTR= Brian Choi Ring $500 B118 $80 ……..$ 580K	1/13/03	1/30/03	2/10/03 2/18/03	2/24/03	3/3/2003 award 3/10/2003 k/o mtg	4/17/2003 Mobilize 5/7/03 start ring 5/7/2003 start B118
3 Cable Plant	UTR= Dak Baltazar/ Ponce Rodriguez Phase 2 Install ($550K)	3/3/03	3/18/03	3/25/03	4/2/03	4/9/03	5/14/2003 MOBILIZED 06/04/2003 START
4 B118 ($500k)	UTR= Lori Shewchuk/Paul Bellomo-Marge Widmeyer Phase 1 - P.S. Removal Phase 2 - P.S/ AC Install	1/13/03	1/21/03	1/28/03	2/14/03	2/18/2003 award 2/25/2003 k/o mtg	03/25/2003 MOBILIZED a) 03/31/2003 START b) 06/11/2003 START
5 LCW	UTR= Harry Shin/ Ihi Nzeadibe ($100k) a) East & West LCW Mods Phase 1 & 2; North & South Arc returns	1/27/03	2/6/03	2/10/03	2/18/03	2/25/03 award 3/4/2003 k/o mtg	4/15/03 4/28/2003 Finish phase1 6/20/2003 start phase 2
6 Supports	UTR= Larry Cadapan/ Domenico Dell'Orco ($100k)	4/15/02	4/22/02	5/1/02	5/13/02	5/19/03 award 5/26/2003 k/o mtg	6/1/2003 MOBILIZED 06/20/2003 START

The overall installation time line is described in the table below. These dates reflect the most current schedule at 10 hours per day for all activities and two-shift operation for vacuum integration work. It is expected that these dates will shift somewhat as the detailed activities are refined.

SPEAR 3 Installation timeline
•Begin April 2003
•SPEAR 2 remove : Mar 31 – Apr 28
•B118 renovation: Mar 31 – Sept 26
•Pour concrete floor: May 01 – June 20
•Install new monuments: June 20 – July 7
•Install mounting plates & holes: July 7 – July 20
•Install Girders & Straights & shielding: July 20 – Aug 20
•Install cable plant: Aug 05 – Sept 18
•Install vacuum hardware & BL Front Ends: Aug 05 – Aug 30
•Leakcheck ring/beamlines- pumpdown : Sept 01 – Sept 19
•Final Survey: Sept 19 – Sept 29
•Lock Ring-Installation complete: Sept 29, 2003

2.1 Accelerator Physics

During the first quarter of FY2003, the SPEAR 3 accelerator physics group focused efforts on simulations of the off-energy dynamic aperture, non-linear coupling into the vertical plane and development of application programs. The model-identification program (LOCO) was completed.

Dynamic Aperture Simulations

Off-energy dynamic aperture and non-linear coupling of large amplitude horizontal oscillations into the vertical plane play a critical role in determining electron beam lifetime. To study these effects in further detail, a simulation was developed to launch particles with variable amplitude in the x-y plane to study ensuing beam dynamics. Figure 1 shows evolution of the dynamic aperture as the energy deviation is increased (dp/p). In good agreement with the 1999 Design Report data, the horizontal dynamic aperture decreased from about 20 mm to 17 mm in increments of approximately 1 mm/percent peak energy deviation of the synchrotron oscillation. The new feature of these plots is explicit monitoring of the effects of a hypothetical +/- 5 mm vertical aperture (ID vacuum chamber). Particles shown in BLUE survive 1024 turns without hitting the vacuum chamber. Particles in RED strike the vacuum chamber and are lost. It is clear from the data that large horizontal amplitudes (Touschek scattering) can couple into the vertical plane and are lost. The effect is most pronounced for large energy deviations. Also evident are the effect of dynamic 'resonances' as the characteristic oscillation frequencies shift with particle amplitude. The resonance lines can be seen as portions of the RED region cutting into the BLUE region resulting in particle loss at ID chambers. These resonance lines can further be correlated to the 'footprint' or plot of tune shift with amplidute (Fig. 2). Footprint plots and associated interpretations of particle motion were developed by the Accelerator Physics Group at the Advanced Light Source. The simulations shown in these plots were performed with the MATLAB Accelerator Toolbox developed as part of the SPEAR 3 Accelerator Upgrade Project.

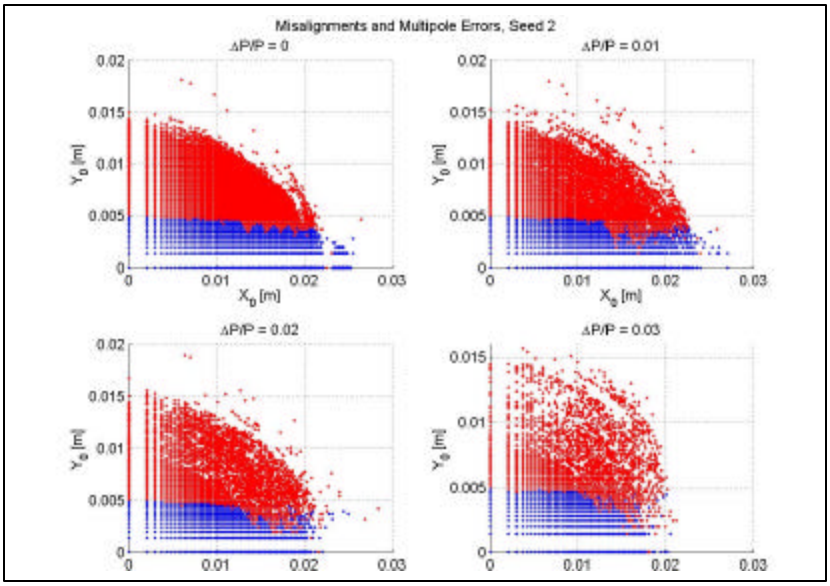


Figure 1: Off-energy dynamic aperture with magnet errors and synchrotron oscillations

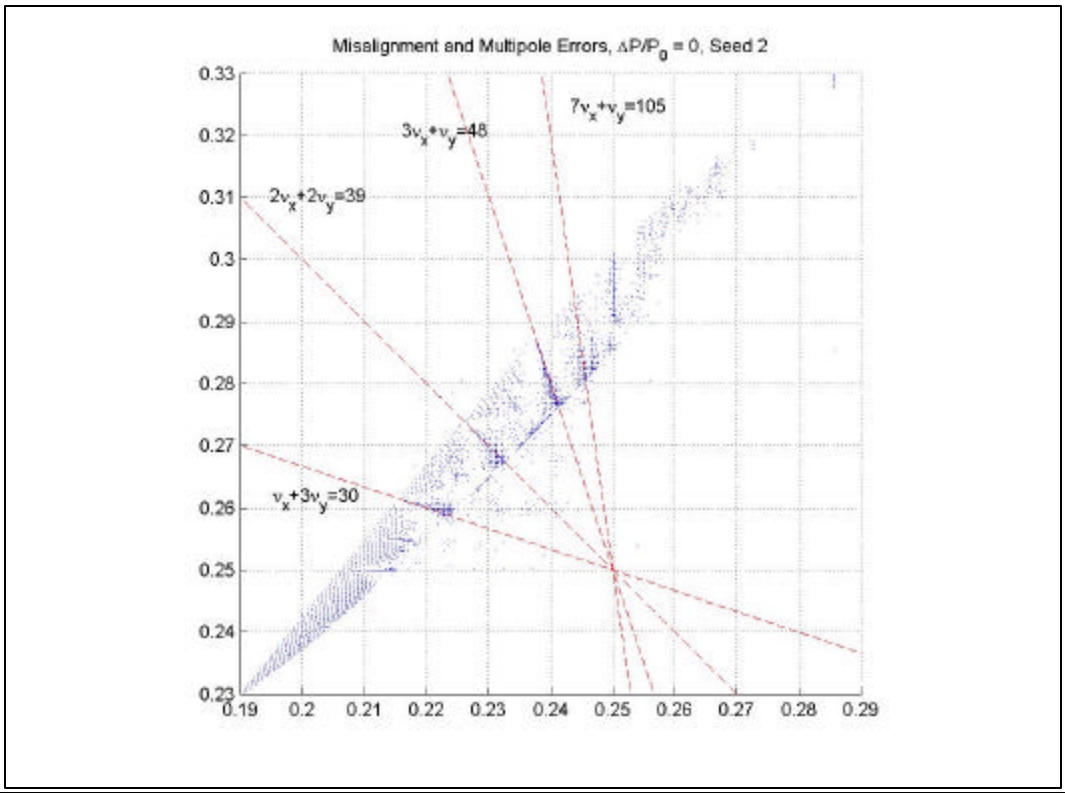


Figure 2: 'Footprint' of betatron tunes as particle amplitudes are scanned through the x-y amplitude plane. Resonance lines and associated orders delineated in red.

Software Application Development

Application development continued in the areas of orbit control, beam-based alignment and orbit interlock verification system. The 'middlelayer' project providing easy MATLAB access to the distributed control system was completed with testing in simulated environment (SPEAR 3) and online environment (SPEAR 2). An informal collaboration with preliminary testing of the system at the Canadian Light Source was established. The model identification project (LOCO) was completed and testing begun on SPEAR 3, Taiwan Light Source and the NSLS at BNL.

Diagnostics

Physics specifications were completed for the DCCT (current monitor), PPS Stopper Modules (Personnel Protection System), Synchrotron Light Monitor and various components associated with the vacuum system. Fabrication has been initiated in each area (see Vacuum System, this Quarterly Report).

Radiation Physics

Formal study and documentation of the electron beam loss scenarios was completed and documented for the upcoming Radiation Physics Review for SPEAR 3. The primary documents are:

1. Electron Beam Loss Estimates in SPEAR 3 (SSRL-ENG-NOTE M371)
2. Injection Beam Loss Angle (SSRL-ENG-NOTE M423)
3. SPEAR 3 Main Ring Stoppers (SSRL-ENG-NOTE M426)
4. SPEAR 3 Fixed-Radius Beam Collimator (SSRL-ENG-NOTE M427)
5. Physical Apertures in SPEAR 3(SSRL-ENG-NOTE M428)

2.2 Environmental Safety & Health

Work towards comprehensively assessing the shielding and design parameters for SPEAR 3 is coming to fruition. Draft documents that cover the beam loss scenarios and shielding requirements are now available. The next step will be get SLAC Radiation Safety Committee approval and define an implementation plan. Effort is also being provided to ensure that the Personnel Protection System and Beam Containment Systems proposals are also written up and provided to the RSC for their approval.

The Safety Analysis Document is in draft format (outside of Chapter 6 – Ionizing Radiation Hazards). It will be issued to the DOE and internal to SLAC once this section is complete. We are still hopeful that it will be before 1/31/03.

Our efforts will then turn to the hazards plan for SPEAR 2 demolition and removal. Hazards have been identified and techniques for removal or mitigation developed. We now need to provide documentation (a hazards plan) to support the plans execution.

We are also focusing on the Accelerator Readiness Review, which will address the following:

- Identification of equipment and systems having safety importance – Hardware Readiness.
- Identification of procedures necessary for safe operation – Procedure Readiness.
- Identification of personnel necessary for safe operation and define minimum training requirements – Training Readiness.

We anticipate holding an ARR in the June/July timeframe.

Other ongoing efforts include providing and organizing resources for the SPEAR 3 installation, including radiation control technicians, safety personnel and “processes” that allow clear two way communication of ES&H goals, between SPEAR 3/SSRL management and everyone out in the field.