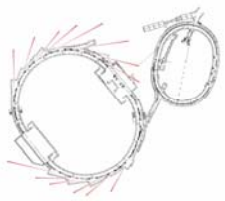
ES&H



Ian Evans

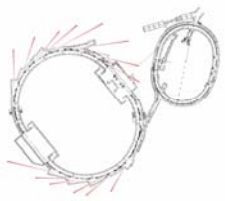
SSRL Safety Office

SPEAR3 Phase II

Accelerator Readiness Review

June 07, 2005

SPEAR3 500mA ES&H

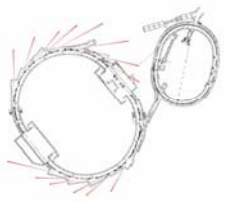


October 2003

– Completed Accelerator Readiness Review for Phase 1

- Energy 3 GeV
- Maximum Current 105 mA
- Injected Beam Power 1.5 watts

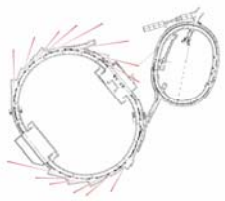
Phase 1 ARR



- **No findings**
- **6 Concerns**
  - **Review by fire marshal for life safety issues**
  - **Develop system for isolating beamlines at currents > 100mA**
  - **Hazards analyses for LION system gas**
  - **Vacuum trip levels and bremsstrahlung**
  - **Review integration of Electrical Hazards into PPS**
  - **Complete list of reviews and procedures that must be completed before startup**

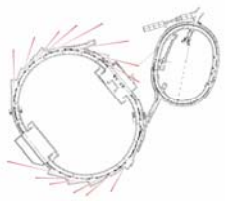
All concerns addressed before startup of SPEAR3 and validated in meeting with ARR Chair and DOE in October, 2003.

Phase 1 ARR



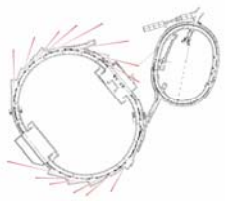
- 7 Opportunities for Improvement
  - 6 items to help improve SAD
  - 1 item (recommendation) that LION's be interlocked into Beam Containment System. The LION system includes this provision and it will be implemented before routine operations at injection powers > 1.5 watts
- 9 Observations
- 5 Note worth practices

SPEAR3 Start-Up



- **Successful SPEAR3 start up and commissioning**
- **Initial user run - uptime (as a measure of success) was 97.1%**
- **FY2004 downtime – no significant system changes**
- **100mA stored beam (but not for long)**
- **SLAC's Electrical Accident – 10/11/04**
  - ALL ACCELERATORS TURNED OFF UNDER DIRECTIVE FROM SLAC DIRECTOR
  - HAZARDS SECURED
  - ACCESS RESTRICTED

Post Accident

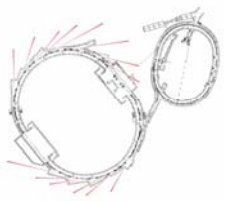


Immediate Actions Taken

Review:

- all safety documents
- all training requirements
- work area for hazards
- discuss with group, “what can we do better”
- ensure Job Hazard Analysis and Mitigation process was complete for all staff, as well as Area Hazards Analysis for all areas

Post Accident

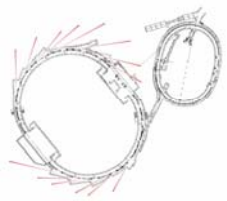


Months of November-December (SSRL Division)

SSRL commences detailed review of Accelerator, Beamline and User Programs that would:

- Identify weaknesses, especially with respect to program compliance with interim ES&H bulletins
- Suggest improvements
- Ensure programs are consistent with SLAC's Integrated Safety Management Program (ISMS) and Job Hazard and Mitigation Process.

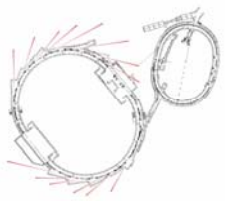
Restart Process



Critical look at systems, using elements of "Safety at Accelerator Facilities - DOE420.2B", conducting an Accelerator Readiness Review as basis for restart plan

- ARR is a method for verifying contractor readiness to conduct specific activities within an accelerator facility
- The only guiding document we had

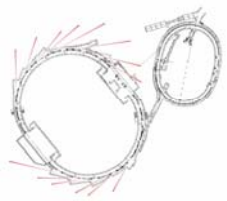
Restart Plan



Outcome was the SSRL Restart Plan, which documents how Accelerator Systems Department and Experimental Systems & Research Department have validated their programs.

- Specific steps taken to respond to Directives and ES&H bulletins post 10/11
- Descriptions of new safety related policies and procedures developed and implemented since 10/11
- Descriptions of operational policies and the implementation of Safety Management Systems and how they have changed since 10/11
- Detailed restart plans for SSRL Accelerators and Beamlines, including required safety related procedures and how they have been revised to comply with new policies.

Phase 2 ASE



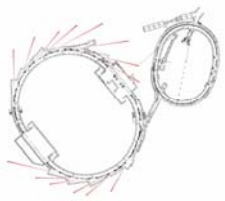
June 2005

Define new Accelerator Safety Envelope

Nominal Operating Conditions

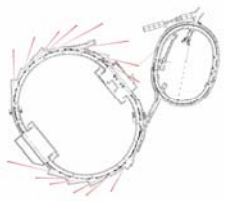
- Energy 3 GeV
- Maximum Current 500 mA
- Injected Beam Power 5 watts

Maximum Credible Accident



Accelerator Optics, Collimation, Access Control Logic, and Shielding (bulk and local as necessary) are chosen such that in the case of the maximal credible accident, where only passive devices are present, the effective dose equivalent that can be experienced by an individual outside the secured areas will not exceed the SLAC limit of 25 rem averaged over one hour.

Monitors/Interlocks & Events

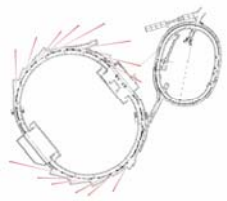


Beam monitors and associated interlocks are designed such that inadvertent excess beam loss or beam power results in a failure mode.

Any failure triggers a shutdown process.

- **Monitors & Interlocks**
  - Average Current Monitors (ACM)
  - Direct Current Current Transformer (DCCT)
  - Stored Current Interlock (SCI)
  - Beam Shut Off Ion Chamber (BSOIC)
  - LION (long Ion Chamber)
  - Personnel Protection System (PPS)
  - Machine Protection System (MPS) – water temperature, orbit interlock, vacuum pressure etc.
- **Events**
  - Alarms
  - Fault Logging
  - Power Supply Shutdown
  - RF Power Trip
  - Stoppers Inserted

Protective Systems

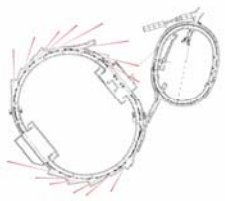


Limits on beam power and beam loss define the physical boundary of the Accelerator Safety Envelope.

Administrative and engineered systems are in place to assure the ASE will not be exceeded.

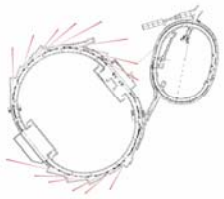
These are summarized as follows.

Beam Power & Beam Losses



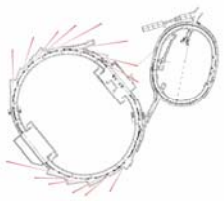
Restraint	Means of Assurance
Beam Power & Beam Loss	1. Injector is tunable to deliver 5 watts (scrappers, limit gun emission) 2. Average Current Monitors set to 5 watts. Exceeding pre-set value terminates injection. 3. Long Ion (LION) chambers measure the average beam loss, compares it to a preset beam level and will terminate injection if the loss exceeds the preset value. 4. Store Current Interlock (SCI) measures stored beam and terminates injection when stored beam reaches its nominal operating value ~500 mA (set point +5%). 5. Beam Shut Off Ion Chambers (BSOIC's) monitor radiation levels around the accelerator and terminate injection if pre-set radiation levels are reached.

Radiation Shielding & Configuration Control



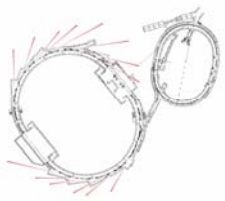
Restraint	Means of Assurance
Radiation Shielding Design	1. Accelerator component, and shielding design and configuration in accordance with SLAC radiological protection guidelines in collaboration with Radiation Protection Department. 2. Review by Radiation Protection Department and Radiation Safety Committee. 3. Field inspection by Radiation Physics Group, SSRL Safety Office and Accelerator Operations staff. 4. Radiation measurements during commissioning and operation to validate design.
Configuration Control	1. Beam Authorization Sheet (BAS) requires inspection of moveable shielding on start up and as part of the on-going operation per the radiation safety checklist procedure. 2. Configuration control via Guideline 14, Guidelines for Operations.

Access & Operations



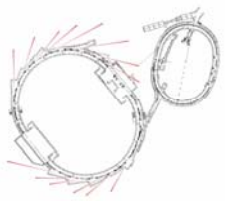
Restraint	Means of Assurance
Personnel Access Control	1. Personnel Protection System (PPS) and Beam Containment System (BCS) design, maintenance and periodic inspection controlled by formal procedures. 2. Design changes reviewed by Radiation Safety Officer with the Radiation Safety Committee. 3. Operation and testing of PPS and BCS controlled through formal procedures. 4. Configuration control via Guideline 14, Guidelines for Operations.
Operations	1. Control room is staffed by a specified number of professional accelerator operators. 2. Operators are qualified in accordance with well established training plan.

In summary



- **Original SAD updated**
  - Updated Accelerator Safety Envelope
  - Reflects observations in Phase 1 ARR report
  - Updated Operating Organization Section
  - Revised other sections as appropriate

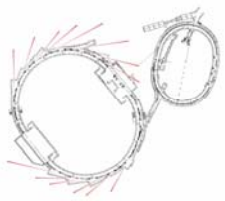
In summary



No new hazards will be introduced for the planned commissioning and operation of SPEAR3 (500mA) within the proposed Accelerator Safety Envelope

- SSRL has identified equipment and systems having safety importance – hardware readiness
  - Shielding
  - Barriers
  - Interlocks
  - Beam Containment System etc.

In summary



- SSRL has identified the procedures necessary for safe operation – procedure readiness
  - A critical review (based on hazards) of procedures required for safe operations was completed for the restart and again for the proposed 500mA operation. Several will change:
    - Beam Authorization Sheet
    - Stored Current Interlock settings
    - Average Current Monitor settings
    - LION's
    - They will be current, consistent with new directives and they will be validated upon implementation
- Personnel and training requirements necessary for safe operation have been defined – training readiness
  - Training based on task and job function
  - Operation and Maintenance staff have established training criteria
    - Beam Authorization Sheet
    - Configuration changes with addition of local shielding
    - Limiting device interlocks (ACM's, SCI