
Adapting to Changes at the SLAC National Accelerator Laboratory

Workshop on Accelerator Operations
2012

Roger Erickson
Accelerator Operations and Safety Division

SLAC



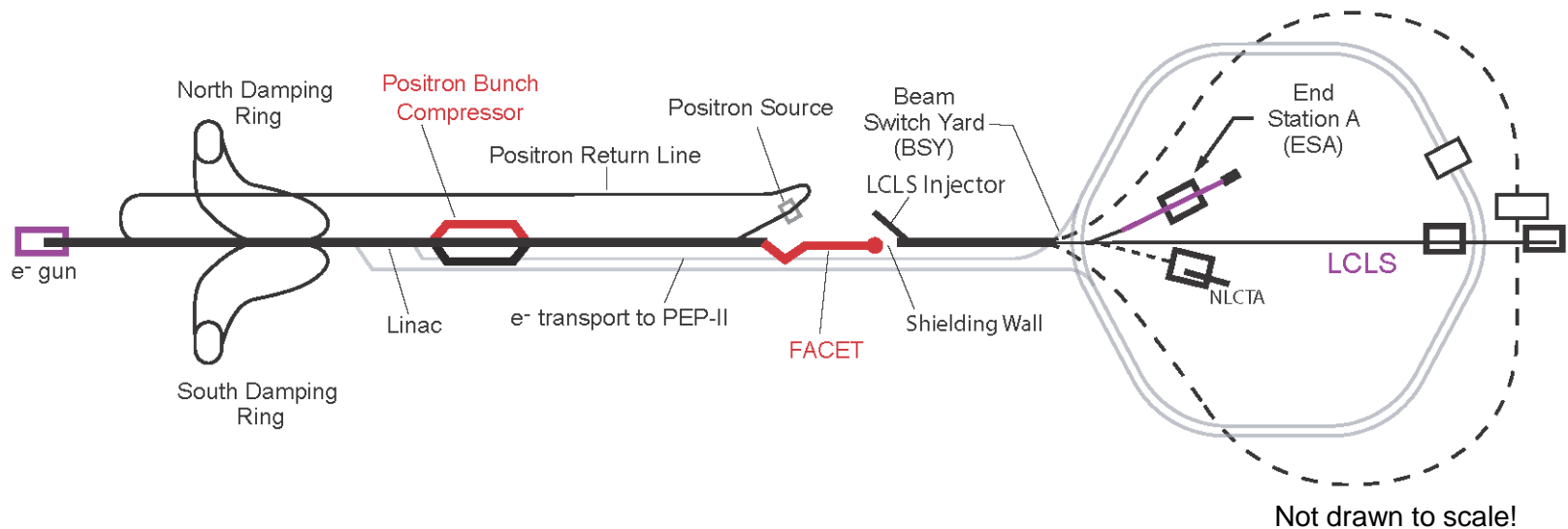
SLAC is operated by
Stanford University for the
U.S. Department of Energy.

Approx 420 acres.
1400 employees.
>3000 users come each year.

SLAC Accelerator Facilities



Schematic Map of Linear Accelerator Facility



When this figure was first drawn, SPEAR3 and its' injection systems were not shown. SPEAR3 was managed by SSRL, a division independent of the other accelerators at SLAC.

A lab-wide reorganization changed everything in 2009. SPEAR3 operations was absorbed by the linac operations group.

Linac Coherent Light Source



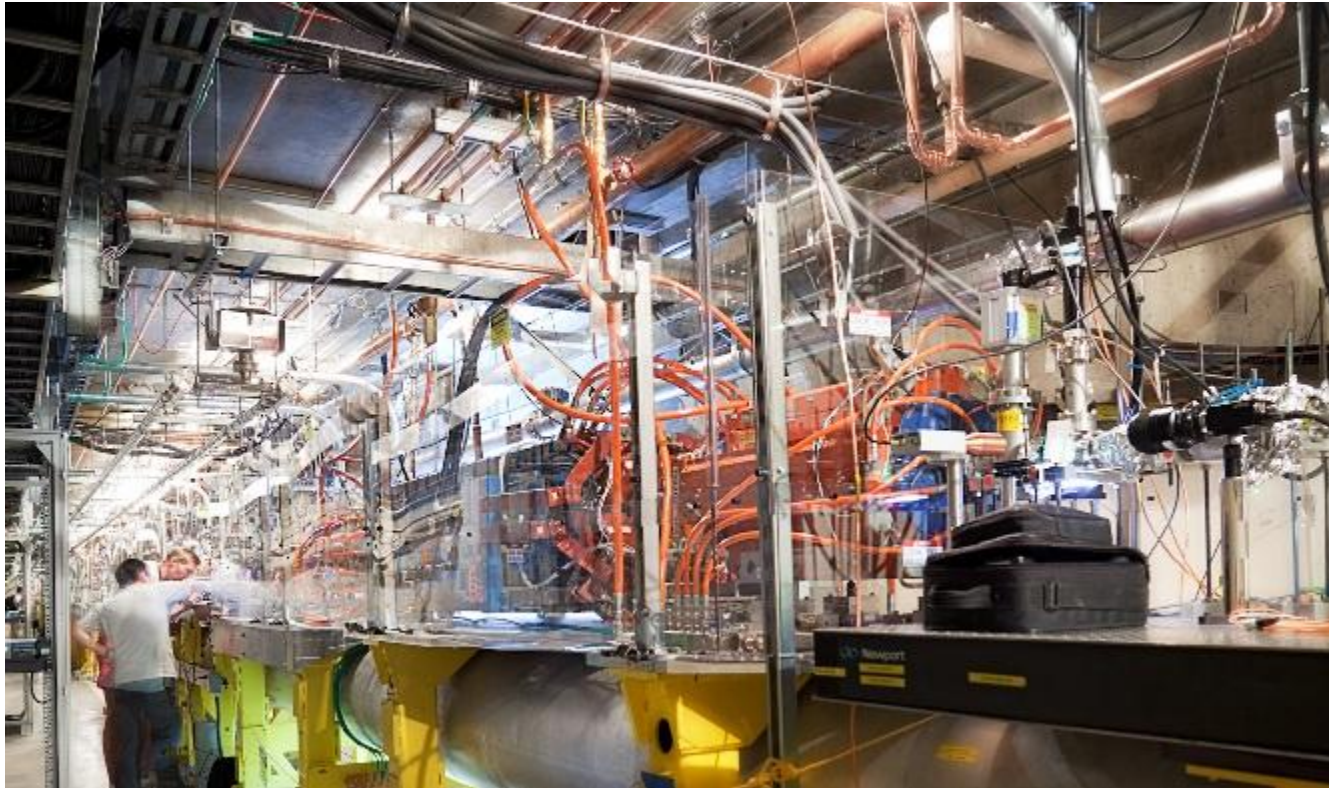
X-ray FEL using the last third of linac delivers extremely intense pulses of nearly Monochromatic coherent x-rays.

Undulator



FACET Area in Linac Sector 20

Facility for **A**ccelerator **E**xperimental **T**esting



Provides intense pulses of electrons or positrons for advanced accelerator R&D programs. Photograph of experimental area in Sector 20 of the linac tunnel.

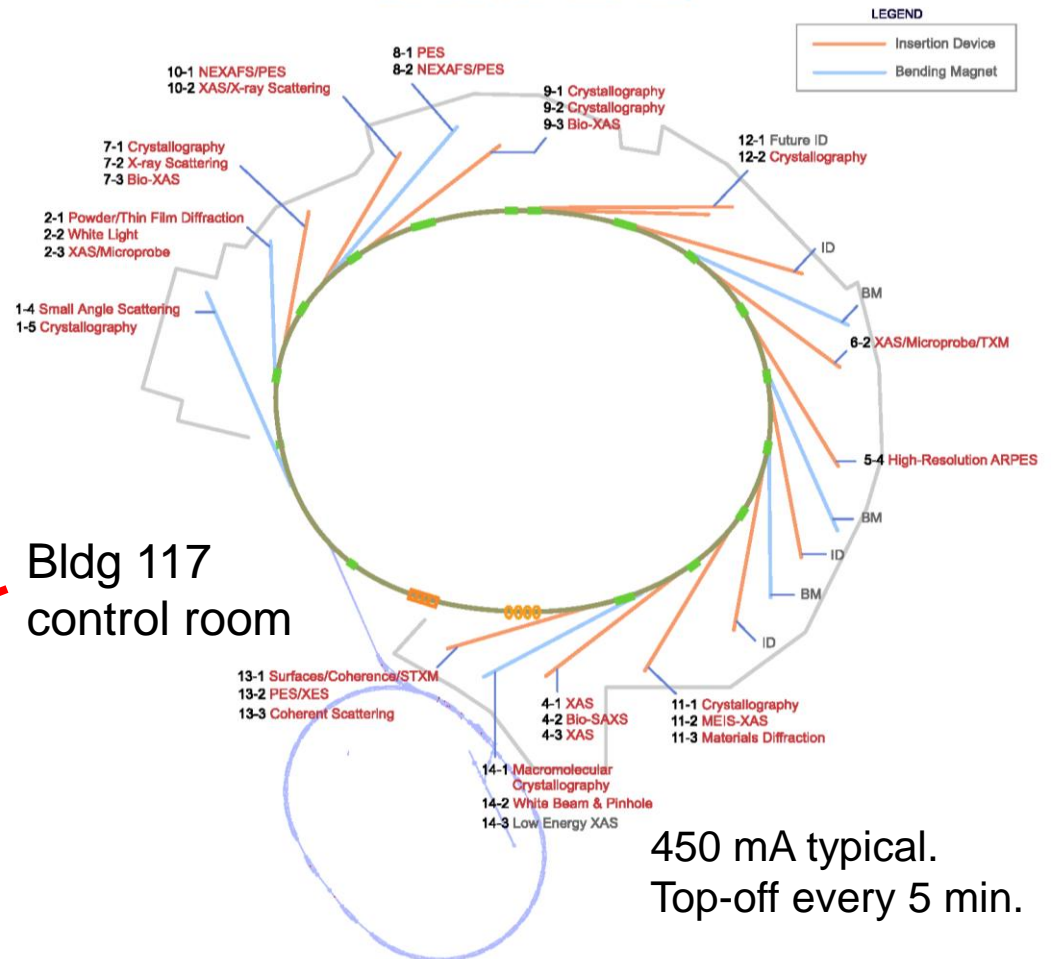
SPEAR 3

3 GeV synchrotron light source



Bldg 117
control room

SSRL Beam Line Map



450 mA typical.
Top-off every 5 min.

Two Control Rooms since Early Days of SLAC

Main Control Center (MCC):

- 2-mile linac and fixed-target beam lines
- LCLS
- FACET
- Test beams
- In the past: SLC, PEP-II, FFTB...

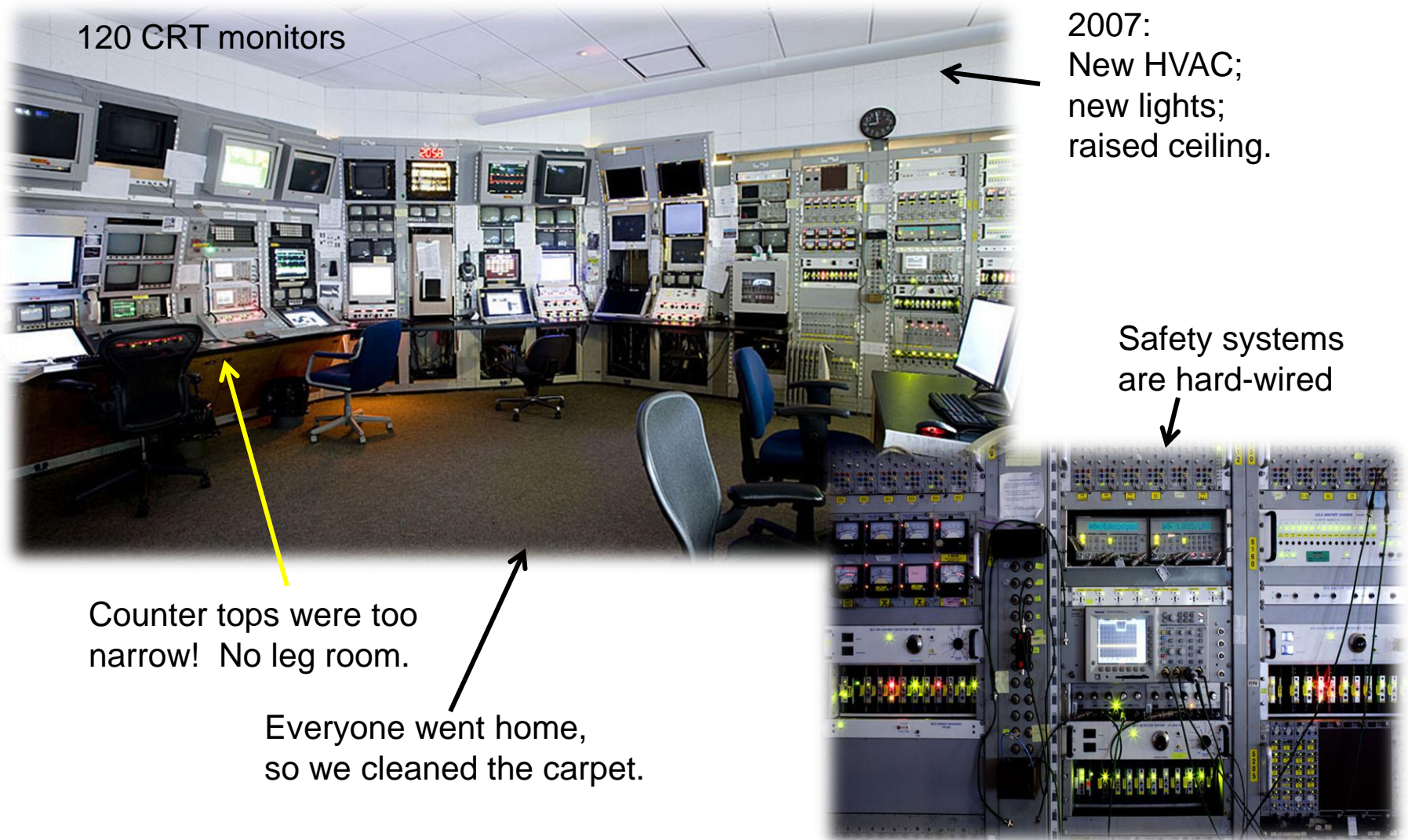
Building 117 Control Room:

- SPEAR (for high-energy collider program)
- Injector linac/booster for SPEAR since 1991
- SPEAR-2 (enhanced for synchrotron radiation)
- SPEAR-3 (rebuilt for synchrotron radiation)

More accurately:

1. In the very early days, CCR was the linac control room.
2. PEP-1 had a separate control room for storage ring.

MCC in 2008: the end of PEP-II



120 CRT monitors

2007:
New HVAC;
new lights;
raised ceiling.

Safety systems
are hard-wired

Counter tops were too
narrow! No leg room.

Everyone went home,
so we cleaned the carpet.

MCC in 2012



No more CRTs!
(nearly)

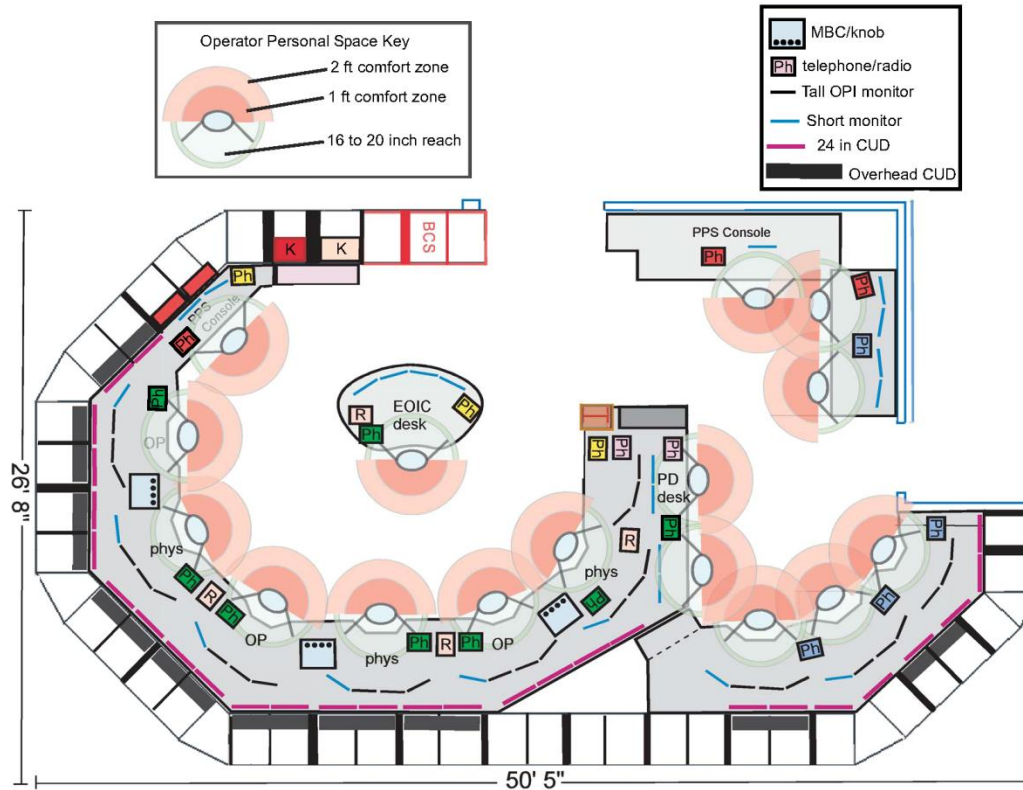
FACET
enthusiasts.

EOIC desk on
motorized jacks.

LCLS enthusiasts.

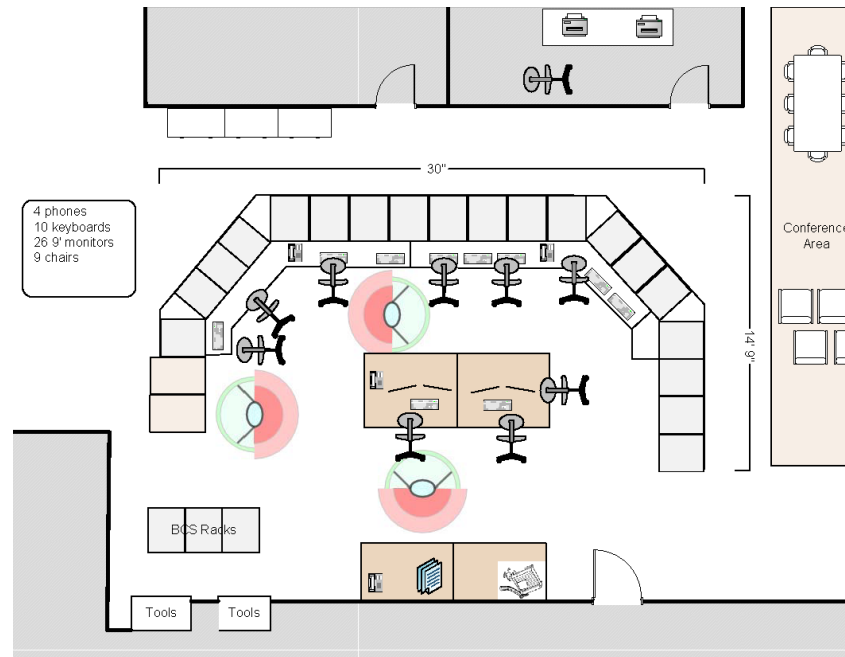
SPEAR 3 enthusiasts off screen to the left.

MCC as it exists today



- 9 full-function workstations
- 6 limited-function workstations + 5 more in foyer
- 17 keyboards
- 15 chairs

SPEAR3 Control Room – Bldg 117



This control room becomes a very lonely place at night.

Operation of SPEAR3 from MCC

Operation of SPEAR3 from Building 117 has worked OK for 40 years.

Why change?

- Consistency in linac/SPEAR3 conduct of operations.
- Economies of scale compared to separate control rooms.
- More efficient use of operators.
- More trained operators available when needed for operator-intensive activities (e.g., 6 ops needed to search the Beam Switch Yard) and when recovering from maintenance days.
- Improved career advancement opportunities for operators.

Preparation for Operation of SPEAR3 from MCC

Expanded MCC administrative control systems to include SPEAR3:

- Electronic logbook
- CATER maintenance and work-planning-and-control management database system
- Radiation Safety Work Control Forms
- Re-structured formal safety procedures at SPEAR3, including Beam Authorization Sheets, Search Procedures, Entry and Exit Procedures, Interlock Checklists, etc.

All of these are now accessible from any location.

Controls for SPEAR3 in MCC

Set up SPEAR3 remote controls in MCC:

- Dedicated optical fiber network from SPEAR3 to MCC
- Two full-function workstations in MCC for SPEAR3 operation
- Fail-safe emergency-off button and stopper-control capability
- Key-controlled transfer switch from Building 117 to MCC

The original SPEAR3 controls in Building 117 are still available.

Initial Test of Remote Operations

First remote operation tests were earlier this year.

- R2A2's of AOSD staff remained unchanged.
- SPEAR3 was sometimes operated from MCC (by a SPEAR3 operator), but only when another qualified SPEAR3 op remained in bldg 117.
- Operation from MCC only when the scheduled program called for beam to users. Machine studies still conducted from building 117.
- Many minor problems were identified and fixed.
- **No adverse impact on science programs.**

Then, starting three weeks ago...

- Emergency-off and stopper enable switches in MCC were certified.
 - **First operation of SPEAR3 from MCC with bldg 117 unattended.**
 - Machine studies, maintenance days, and all PPS transactions are still carried out by sending a SPEAR3 operator back to bldg 117.
 - Trained MCC operators are beginning to assist with tasks for SPEAR3, including searches and other routine safety procedures.
 - SPEAR3 operators are beginning to assist with LCLS and FACET operations.
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- Note: A person can walk from MCC to bldg 117 in 7 minutes.
6 minutes if you know the shortcut through the cable tunnel.
Driving is even faster.

Approaching Full Unification

Later this year and early next year...

- Training records and summaries will be unified.
- Center-of-mass of training records, operator documentation, safety-related checklists, and related material will migrate from Bldg 117 to MCC.
- SPEAR3 and MCC operators will begin cross-training with greater emphasis on a systematic approach and record-keeping.

After all PPS controls become operable from MCC...

- Most SPEAR3 operations will be conducted from MCC.
- A qualified SPEAR3 operator will still be designated for each shift, and will have primary responsibility for the safety and mission of his shift.

Goal for 2013 and Beyond: Full Unification

Routine operation of the Linac and SPEAR3 from the same control room.

- All operators will be qualified to operate all Linear Accelerator Facility and SPEAR3 Facility accelerator systems.
- The “look and feel” of procedures and checklists for LCLS, SPEAR3, and FACET will be the same.
- Training workbooks will be updated for the combined facilities, and supplemental training workbooks for current operators will be released.
- One Operations Engineer (EOIC) plus three operators on each shift will be able to operate three accelerator facilities simultaneously, safely, and effectively.

The Challenge Ahead

Continuing Operations:

- LCLS-I (last third of linac plus undulator complex)
- FACET (first two-thirds of linac plus Sector 20 focusing system)
- ESTB (End Station Test Beam) in ESA
- SPEAR3 control from MCC
- PPS access control

Coming in a few years:

- LCLS-II
- FACET-II
- Injector Test Facility (using linac west end systems)

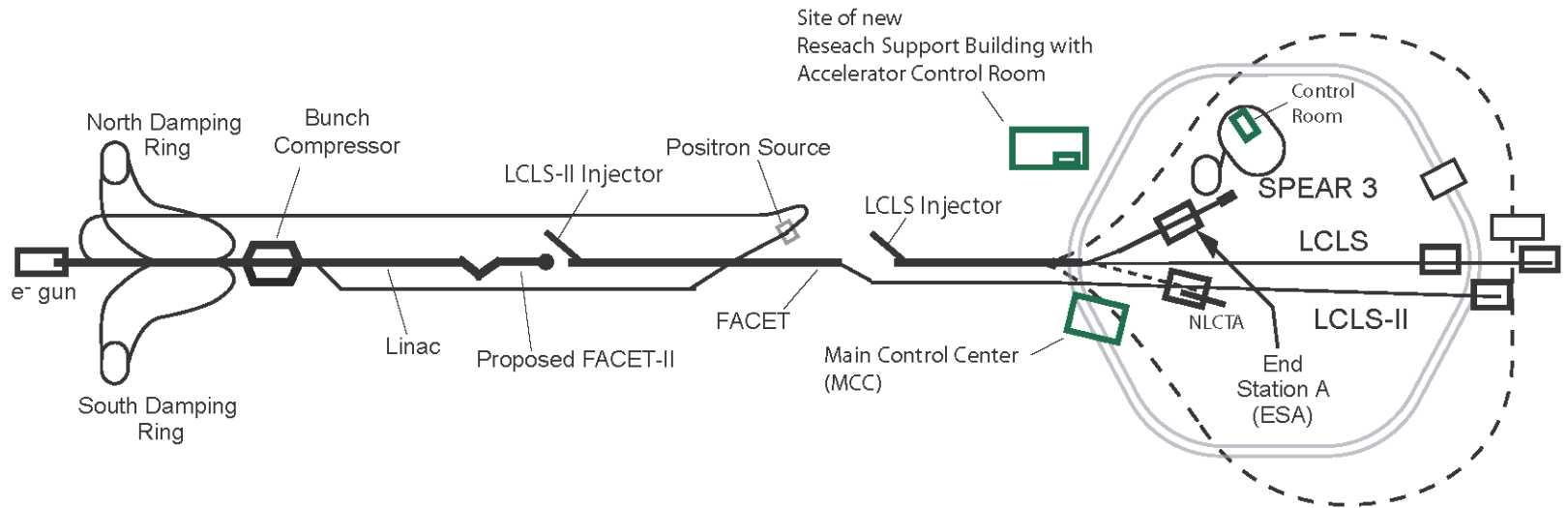
More than a few years:

- PEP-X

Limitations of Existing Control Room in MCC:

- + Adequate for LCLS-I.
- + Adequate for SPEAR3 during smooth running,
 - but not for MD or maintenance days.
 - Crowded for Sector 0-20 / FACET.
 - Crowded for ESA / test beam operations.
 - No room for upcoming LCLS-II.
 - No room for upcoming FACET-II.
 - Injector Test Facility?
 - Other future requirements? PEP-X ?
- Far from accelerator physicists' offices.

Schematic Map in a Few Years



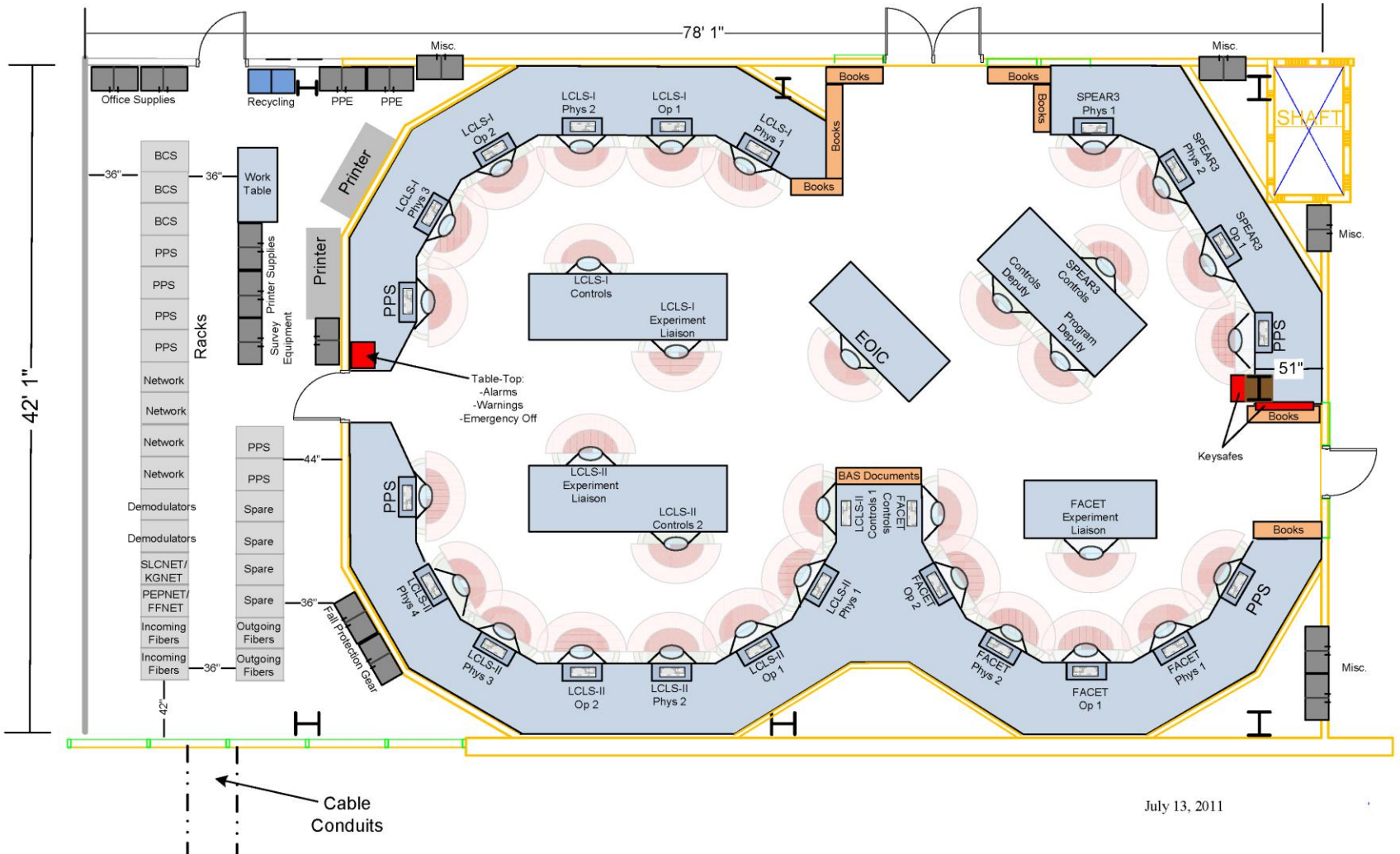
Research Support Building (RSB)

Artist's concept; it hasn't been built yet.

Under construction now.
First occupancy next year.



Conceptual plan for ACR in the RSB



July 13, 2011

2014: A New Control Room in the new RSB

Operation of Linac and SPEAR3 from ACR in the RSB

- Allows operation of LCLS-I, FACET, SPEAR3, ESTB, and eventually LCLS-II, all from one control room.
- Closer to accelerator physicists' offices.
- Better integration of accelerator operations into other AD activities, with potential advantages for all accelerator programs.

Status:

- Depressed area (below computer floor) and cable conduits have been installed.
- Construction of ACR interior and dedicated HVAC start next year.
- Transition date to full multi-program operation from ACR: 2014.

Related Talks at WAO '12

- Zoe Van Hoover: [Electronic Form for Management of Work on Radiation Safety Configuration Controlled Items at SLAC](#)
- Christopher Melton: [Tuning Techniques and Operator Diagnostics for FACET at SLAC National Accelerator Laboratory](#)
- Sean Kalsi: [Optimizing X-ray FEL performance for LCLS at SLAC](#)
- Peter Schuh: [Recommissioning SLAC's West Linac Complex for FACET](#)
- Matthew Gibbs: [Electronic Logbooking at SLAC](#)