PEP-II Disassembly
Technical Systems

PEP-II D&D Review

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Outline

- Project safety
- Disassembly of technical systems
  - Shielding
  - Vac/Mechanical
  - Cable trays and cables
  - RF systems
  - Power supplies
  - Controls
- PEP-Injection
- Cost summary
- Next steps

Basic assumptions

- Only items with general reuse capability will be preserved
- No attempt to prepare a general scheule has been made
- All costs will be expressed in 2007 dollars with SLAC general rate of assigned indirect expenses (38% on labor, 5% on purchases)

Safety Concerns

- It is critical that the dismantling of PEP-II is accomplished while protecting the safety of all workers and the environment.
- Areas of greatest concern
  - Electrical
  - Hoisting/Rigging/Material Handling
  - Fire Protection
  - Construction/Demolition Workplace Hazards
  - Fall Protection, Compressed Gasses
  - Tracking & Management of Activated, Hazardous, & Mixed wastes

Electrical Safety

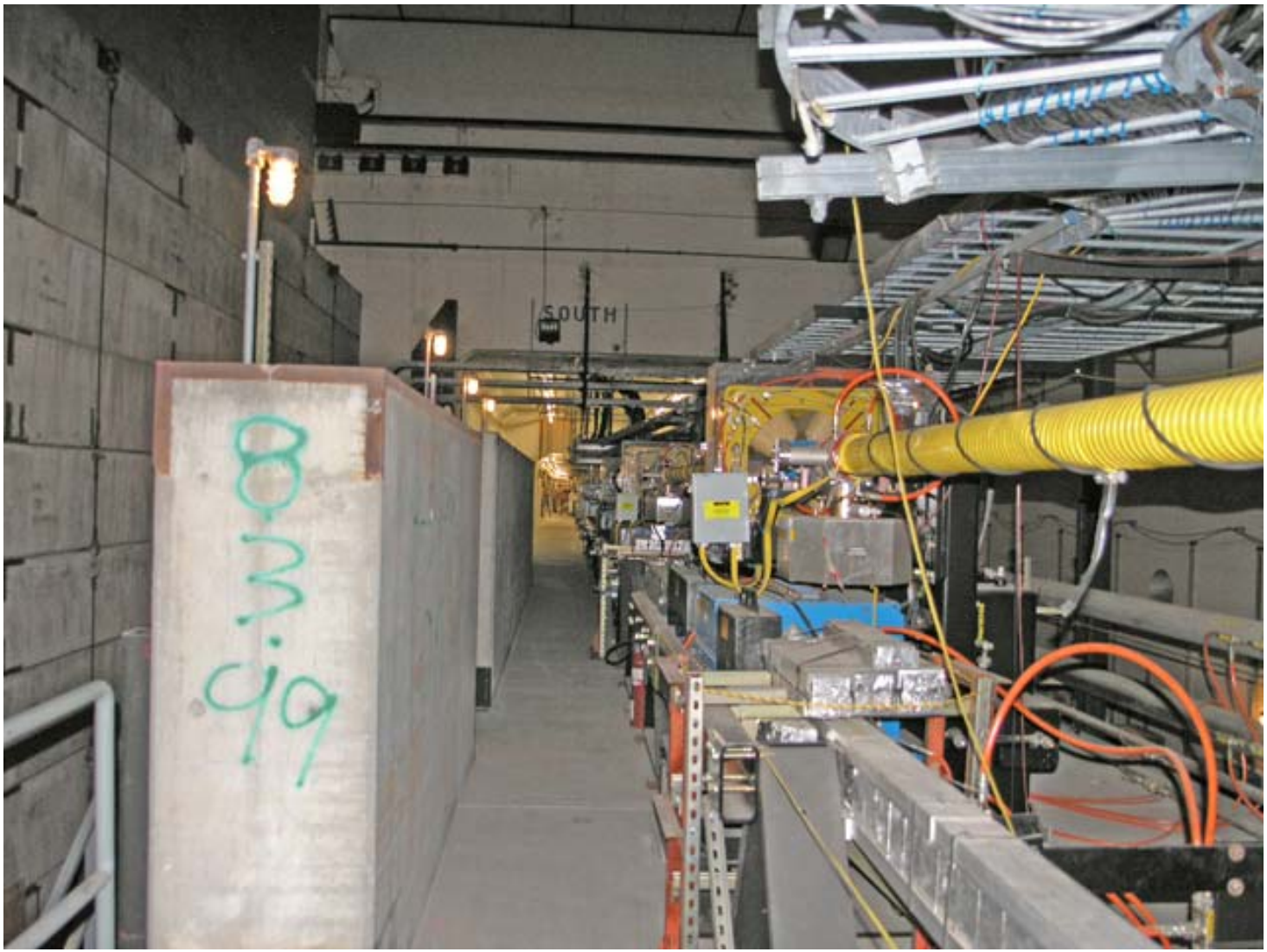
- Electrical Safety program for Final Focus Test Beam was successful. Experience from this project can be readily applied to PEP-II.
- PEP2 is much more complex than FFTB and has new challenges.
  - Conventional and experimental sources of energy are more numerous. Multiple systems (HER & LER, High- & Low-voltage) are commingled.
  - Some PEP-I cables are abandoned in cable trays and covered with PEP-II cables.
- SLAC has made good progress in identifying and labeling electrical hazards.

Davis-Bacon Act

- It is assumed that the dismantling of the PEP-II technical systems will be covered by the Davis-Bacon Act.
- Davis-Bacon covered work estimated to be 20.4 M$
- Certain tasks which require specialized skills will likely be performed by SLAC staff.
- Davis-Bacon exempted work estimated to be 13.4 M$, mostly in project management

Shielding Removal

- 5 IR shielding walls
- IR-8 & IR-12 bridge shielding walls
- Straight section on-bridge steel & lead
- IR-2 tunnel shielding (A&B sides)
- Estimated cost 217 k$



LER Magnet Support Raft Removal

- Remove entire rafts including captured beampipes
- Need to design/procure lifting tools
- Recover & store rod ends
- Transport from tunnel to magnet disassembly location
  - Dipole weight: 2200 lbs
  - Quadrupole weight: 1950 lbs
  - Sextupole weight: 370 lbs
- LER vacuum/mechanical removal estimated cost 1,695 k$

HER Magnet Removal

- Quad rafts to be removed with captured beampipes
- Dipole chambers to be removed separately from dipole magnets
- Need to design/procure lifting tools
- Recover & store rod ends
- Transport from tunnel to magnet disassembly location
  - Dipole weight: 14,750 lbs
  - Quadrupole weight: 4,130 lbs
  - Sextupole weight: 370 lbs
  - Dipole chamber weight: 650 lbs
- HER vacuum/mechanical removal estimated cost 1,615 k$

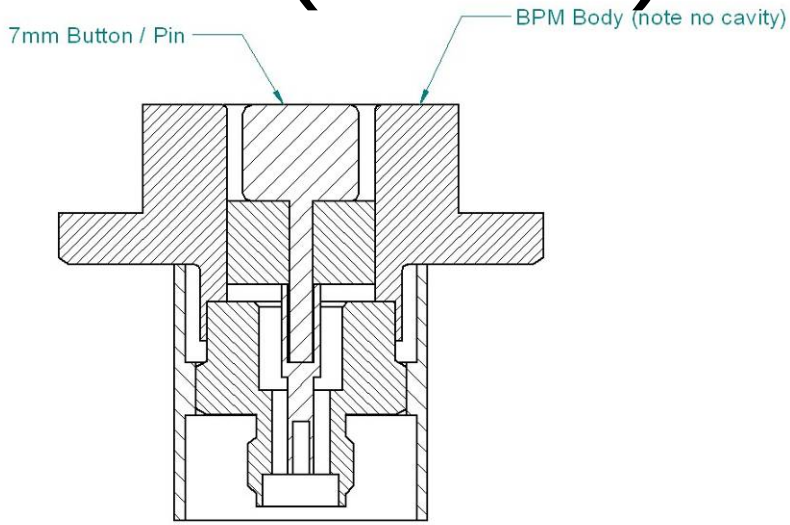
Vacuum Pumps

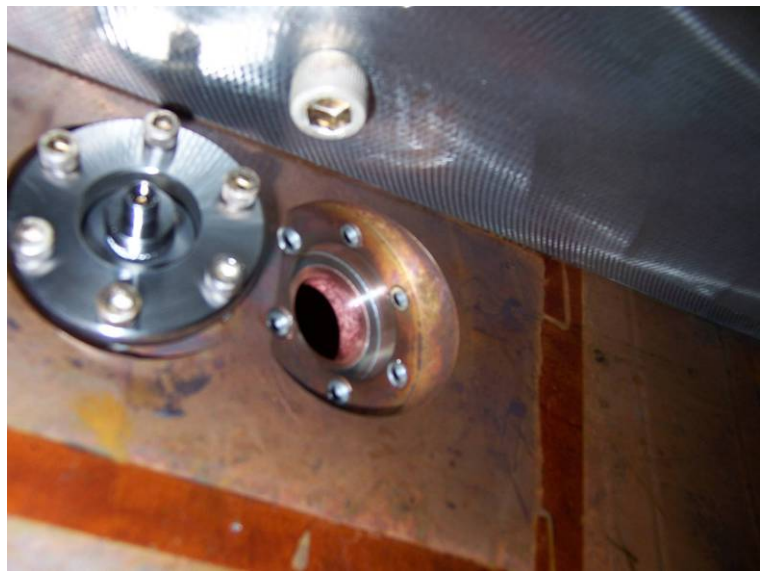
- Vent to dry nitrogen
- Blank off for storage
- Protect HV feedthrough
- Weight of pumps range from 9 lbs. (25 l/s) to 294 lbs. (500 l/s)

Also recover valves, gauges, & Ti Sub Pumps (TSPs)

Beam Position Monitors (BPMs)

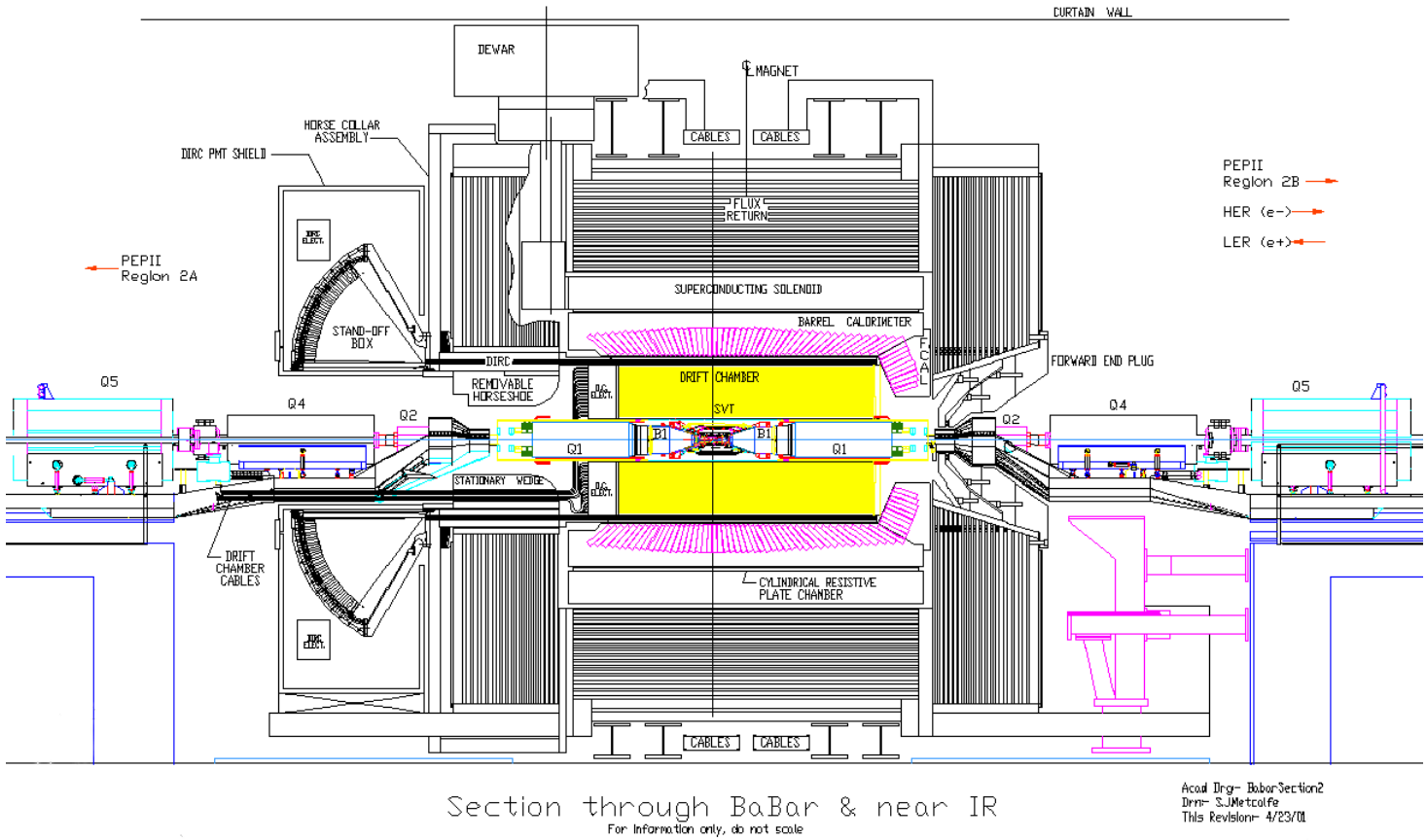
- Save flanged button/feedhrough assemblies
  - ~900 units @ $400 each
  - Handle & store as UHV components
- Cut and discard cables
- FIBs, processors have no reuse
  - PEP-II specific designs
  - Technology has progressed since mid 1990's





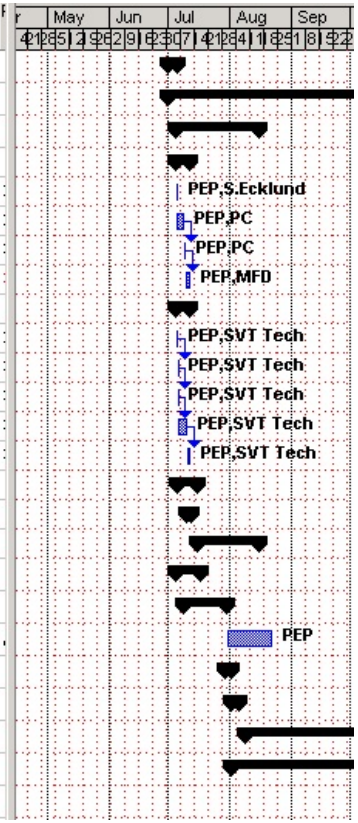
Interaction Region

- Previously disassembled in 2002 for BaBar SVT change
  - One month to remove beamline equipment from Z= -15 m to +8 m (IP=0)
  - Requires combined efforts of PEP and BaBar groups



Portion of 2002 IR/BaBar Schedule

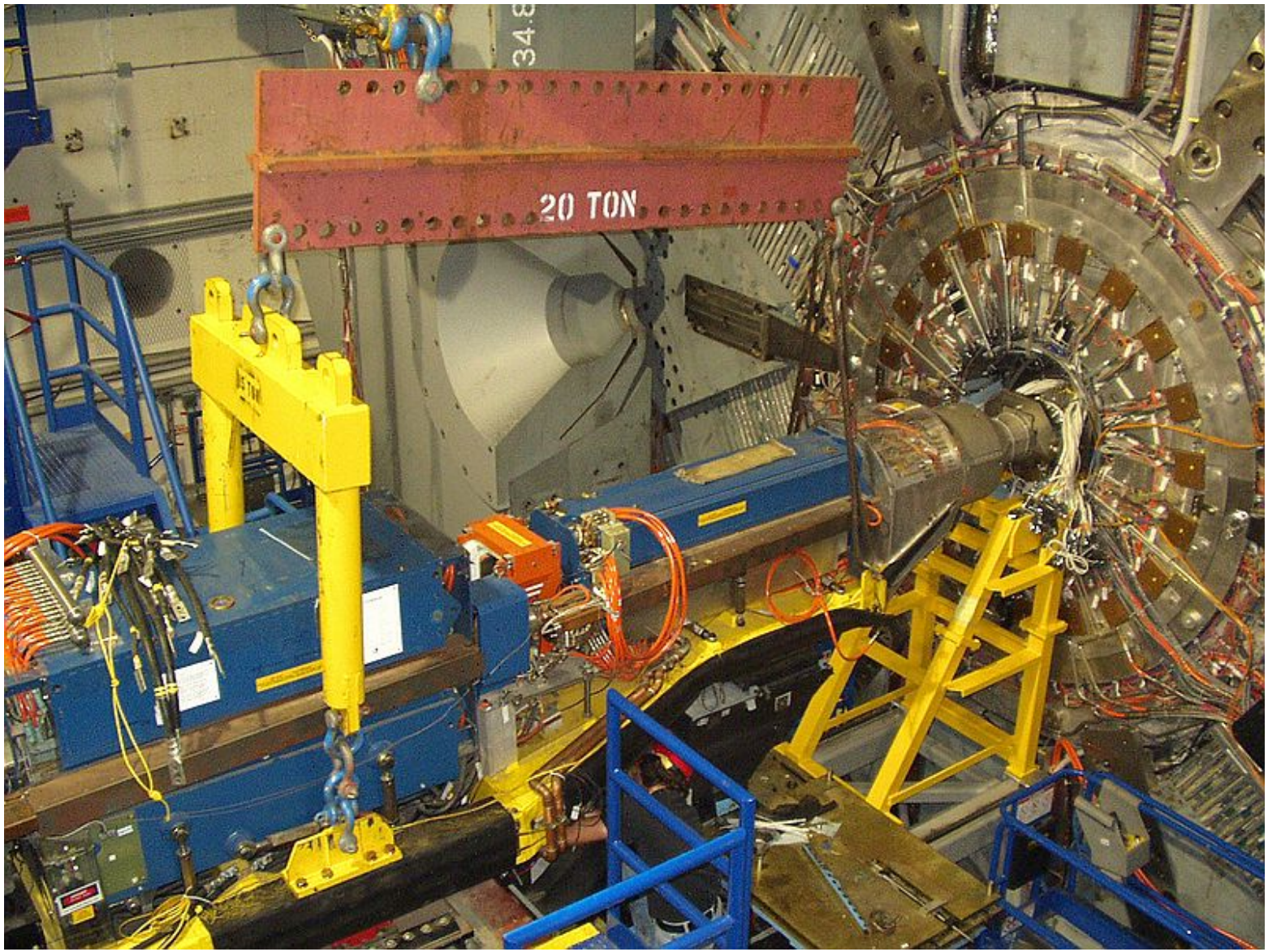
	Task Name	Duration	Start	Finish
205	Preliminary work	3.5 days	Mon 7/1/02	Fri 7/5/02
210	BABAR WORK, PHASE 1 (Pre ST Removal)	69 days	Mon 7/1/02	Mon 10/7/02
369	Remove Backward Raft	29.8 days	Fri 7/5/02	Thu 8/15/02
370	**Disconnect Backward PEPII Services**	**4.5 days**	**Fri 7/5/02**	**Thu 7/11/02**
371	Disconnect TC Cables	0.5 days	Fri 7/5/02	Fri 7/5/02
372	Disconnect Power Cables	2 days	Fri 7/5/02	Mon 7/8/02
373	Secure Cables to Raft	0.5 days	Tue 7/9/02	Tue 7/9/02
374	Drain, Disconnect & Plug Water Cooling Systems	2 days	Tue 7/9/02	Thu 7/11/02
375	**Disconnect Backward SVT Services**	**4.35 days**	**Fri 7/5/02**	**Thu 7/11/02**
376	Drain, Flush and Disconnect Cooling System	0.25 days	Fri 7/5/02	Fri 7/5/02
377	Disconnect Dry Air Hoses	0.1 days	Fri 7/5/02	Fri 7/5/02
378	Disconnect White Cables at Front of Raft	0.5 days	Fri 7/5/02	Fri 7/5/02
379	Disconnect White Cables at MUX Racks	3 days	Fri 7/5/02	Wed 7/10/02
380	Secure Cables at Raft	0.5 days	Wed 7/10/02	Thu 7/11/02
381	**Disconnect Backward DC Services**	**5.7 days**	**Fri 7/5/02**	**Mon 7/15/02**
395	**Disconnect Backward Vacuum**	**2 days**	**Wed 7/10/02**	**Fri 7/12/02**
400	**Disconnect ST and Raft, Remove Backward Raft**	**23.25 days**	**Mon 7/15/02**	**Thu 8/15/02**
413	Remove Beamlines in Tunnel to -15m from IP	8.75 days	Fri 7/5/02	Wed 7/17/02
430	Remove Forward Raft	15.3 days	Tue 7/9/02	Tue 7/30/02
457	Replace Q2 Chamber on Forward Raft	16.81 days	Tue 7/30/02	Thu 8/22/02
459	Install supports and remove Support Tube	2.8 days	Mon 7/29/02	Thu 8/1/02
469	Prepare to close Forward Doors	1.5 days	Thu 8/1/02	Mon 8/5/02
475	BABAR WORK, PHASE 2 (ST Removed)	67.05 days	Fri 8/9/02	Wed 11/13/02
640	ST Repairs	47.9 days	Thu 8/1/02	Wed 10/9/02
651	OPEN FORWARD DOORS	1.5 days	Tue 10/8/02	Wed 10/9/02



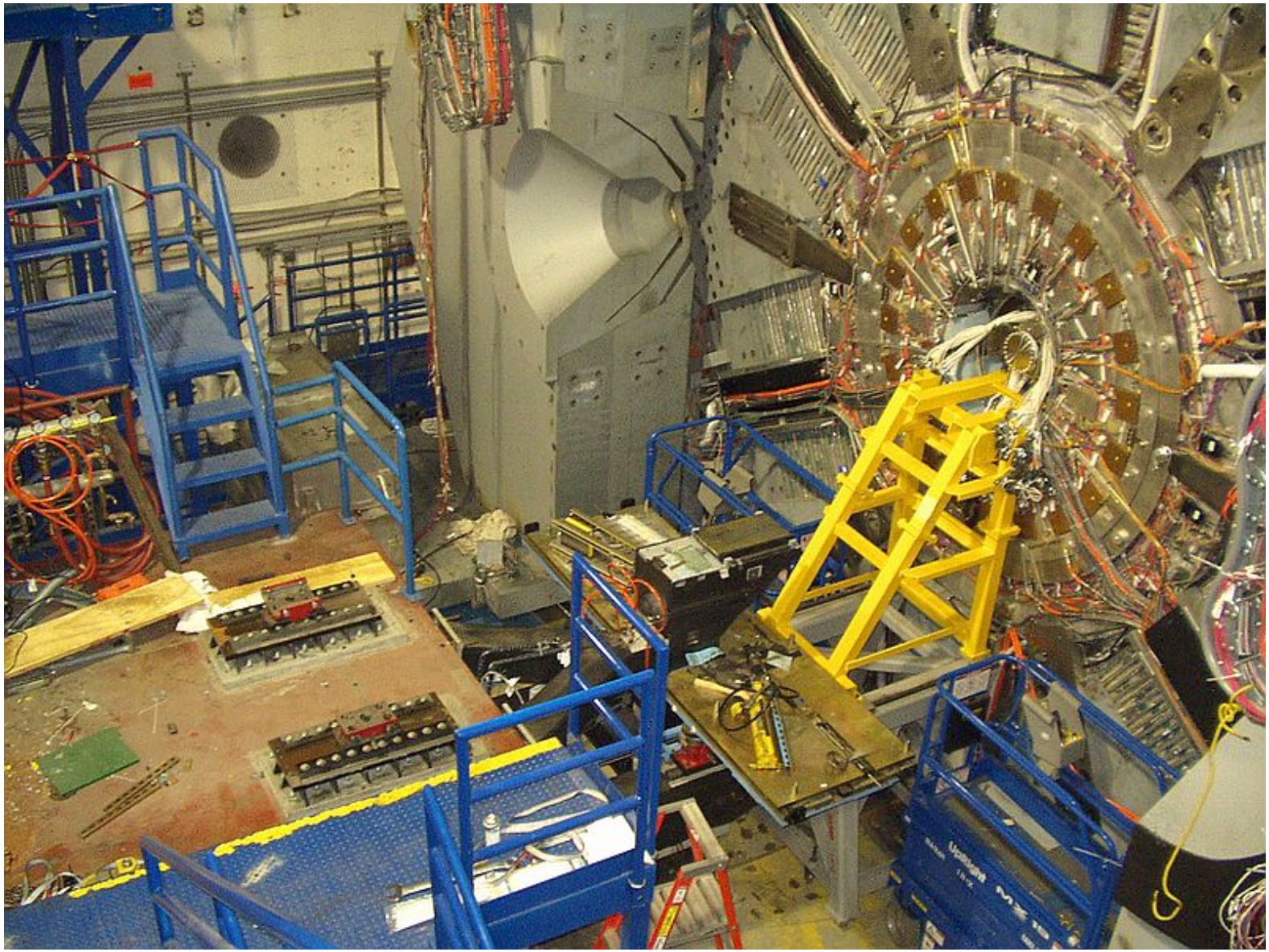
Schedule contains 794 task and roll-up items

Forward Raft Removal

BaBar doors opened, cables and services disconnected to permit access

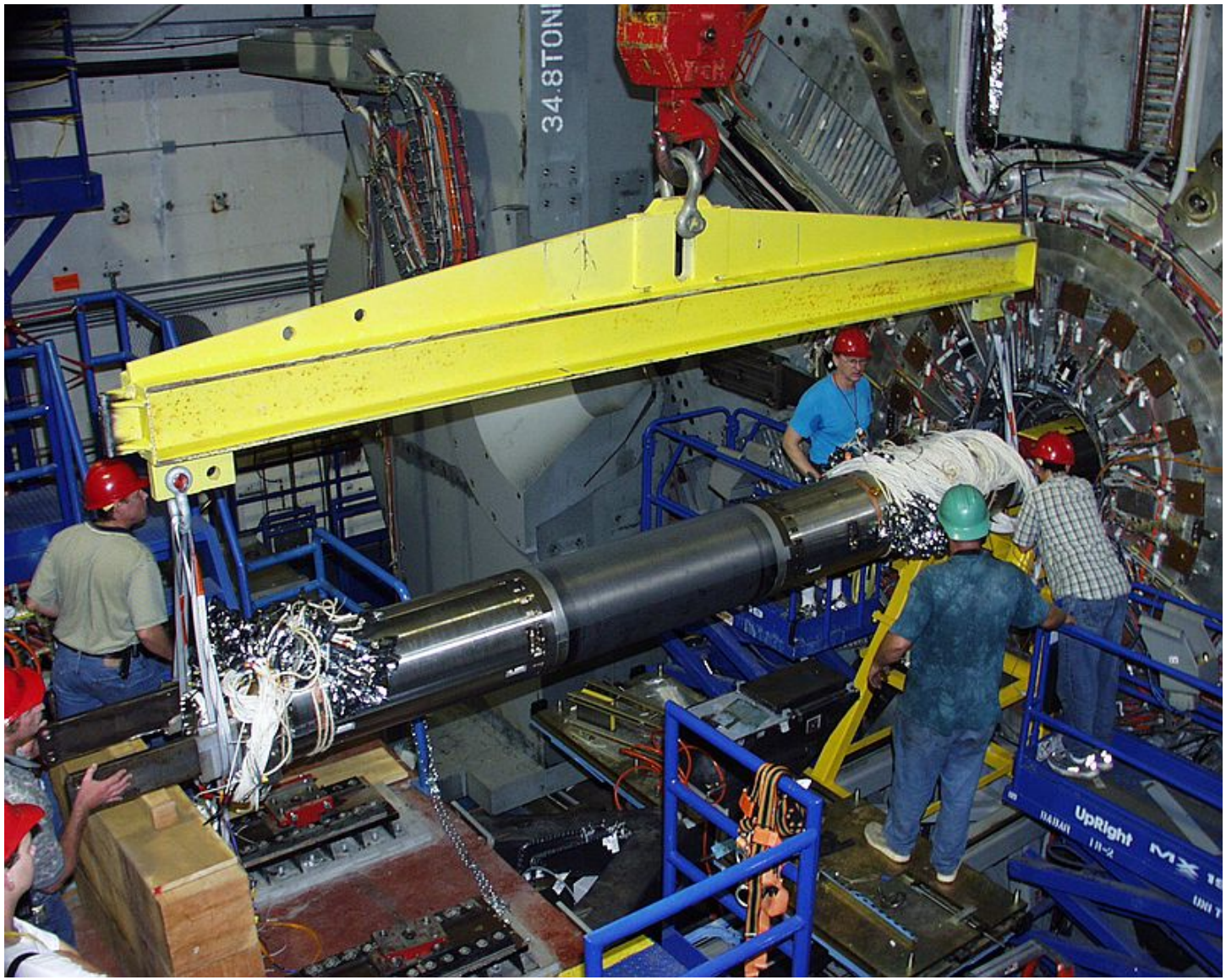


Forward Raft Removed



Support Tube Removal

Carbon fiber center section encloses SVT



Support Tube Disassembly

- Three weeks to remove SVT from support tube
- PEP permanent magnets require special handling during disassembly and storage
- Disassembly and disposal of beryllium central beampipe will require coordination with E,S,&H experts

Photo courtesy of Peter Ginter

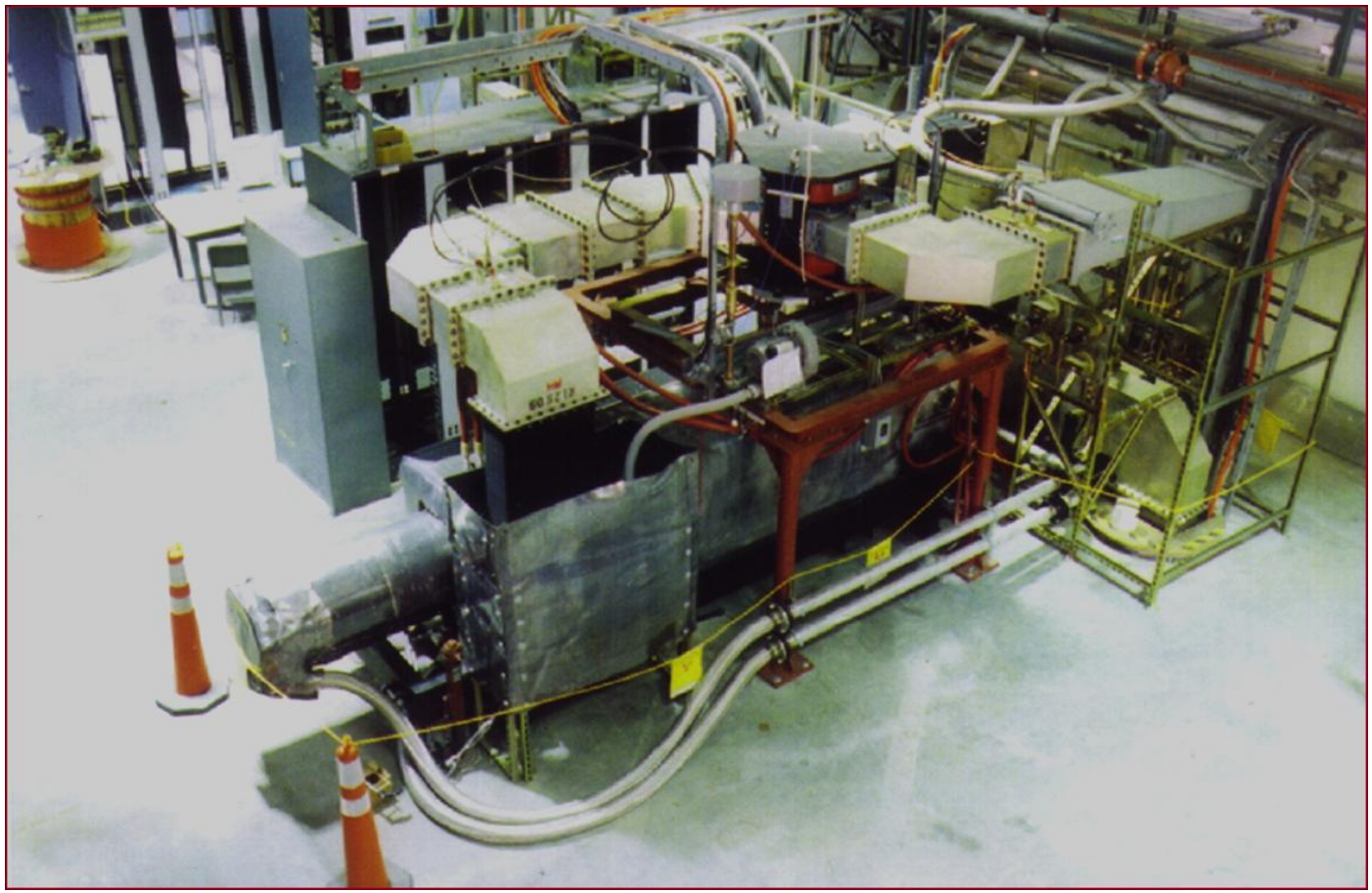
Cable Trays- FFTB Experience

- FFTB removed in 2006
- Cable plant deenergized, “arterial cuts” made, then cable tray was cut into manageable sections *in situ* and removed
- 645 feet of beamline, cable trays, & housing removed
- Costs (SLAC + Davis-Bacon contractor) 522 k$ or ~ $809/foot

Cable Trays in PEP

- Generally 4 trays (arranged in a 2 x 2 pattern) throughout tunnel
- Each tray much more heavily loaded than FFTB
- Ceiling mounting adds to difficulty of removal
- Using FFTB rate as a baseline:
- $809/ft x 7200 ft (PEP circumference) x 2.5 (factor for greater amount of PEP-II trays per linear foot) =
  ~ 14.526 M$

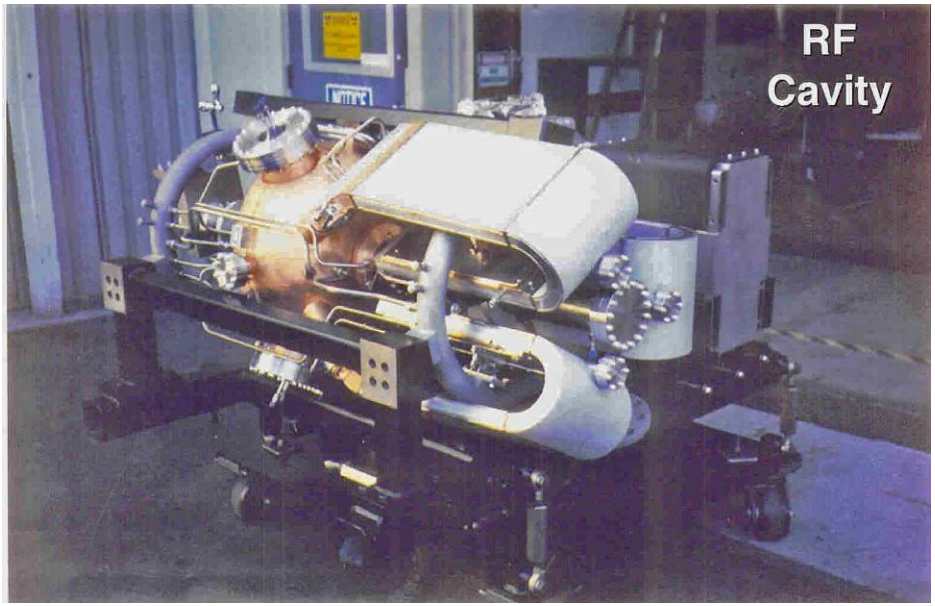
RF Systems

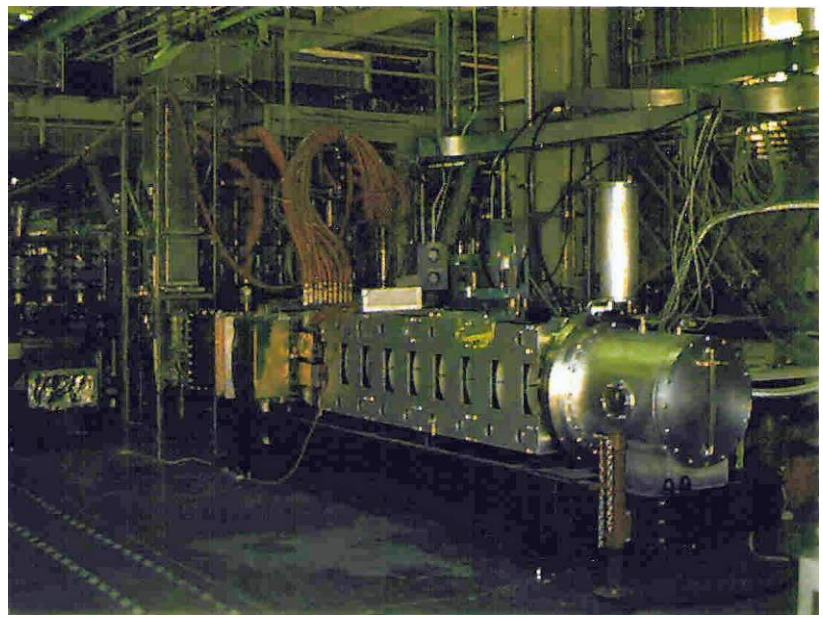


- Many items identical to SPEAR RF
  - Major components to recover:
    - Klystrons
    - Circulators
    - Waveguide
    - Low Level RF
    - Water racks
- 15 stations to dismantle and store

RF Systems

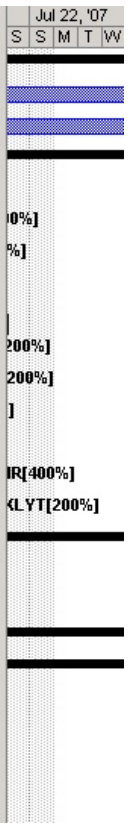
- Components designed for transport on supports
- LLRF can be transported in existing racks
- Recent experience with installation gives good confidence in disassembly plans
  - Disassembly estimated to require 220 days and 966 k$.
  - Parallel work possible (Components installed in three PEP Regions)





RF Removal Schedule

	Task Name	Duration	Predecessors	Remaining Cost	Resource N
1	**PEP RF Removal and Storage**	**220 days**		**$699,791.52**	
2	Coordinate PEP RF Removal	220 days		$114,470.40	KLYC
3	Provide UTR support	220 days		$151,307.20	CEFE
4	**Region 8 (3 Stations)**	**49 days**		**$120,266.60**	
5	**LOTO power, water, pressurized air**	**0.5 days**		**$1,003.46**	
6	Remove the fuses from 12kv switchgear	0.5 days		$448.00	CEFPM
7	Loto RF system water pumps on pad	0.5 days		$448.00	CEFPM
8	LOTO pressurized dry air system	0.25 days		$107.46	KLYT
9	**Remove 3 klystrons from B685 and store**	**4 days**	**5**	**$5,464.98**	
10	Disconnect water	1 day		$896.00	CEFPM
11	Disconnect HV cable	0.5 days		$520.32	PEM TE
12	Disconnect waveguide	0.5 days		$429.84	KLYT[2
13	Disconnect LLRF cables	0.25 days		$107.46	KLYT
14	Move klystrons to storage	1 day	10,11,12,1	$1,792.00	CEFPM
15	Store klystrons under vacuum	2 days	14	$1,719.36	KLYT[2
16	**Remove 3 circulators from B685 and store**	**5.5 days**	**9**	**$5,678.72**	
21	**Remove 3 water racks from B685 and store**	**12 days**	**28**	**$10,752.00**	
28	**Remove 3 waveguide systems from B685 and store**	**20 days**	**16**	**$21,140.80**	
35	**Remove Cabling and trays from B685**	**40 days**		**$35,840.00**	
42	**Remove 12 RF cavities from PR08**	**30.5 days**		**$32,395.28**	
47	**Remove LLRF equipment**	**9 days**		**$7,991.36**	
52	**Region 12 (6 Stations)**	**66 days**	**4**	**$156,873.66**	
53	**LOTO power, water, pressurized air**	**1 day**		**$1,451.46**	
57	**Remove 6 klystrons from B725 and store**	**8 days**	**53**	**$10,033.96**	



RF High-Voltage Power Supplies

- 15 HVPSs installed in PEP (one for each Klystron)
- Secondary containment required if stored while filled with oil
- Cost to disassemble, transport, & store estimated at 689 k$

Power Supplies

- Experience from recent FFTB work
- Similar to Electrical Work Plan "*FFTB Beam Line Magnet Disconnection for Removal …",* CPE 0129
- Rack mounted power supplies (321)
  - Most use BITBUS interface
  - Identical to SPEAR power supplies
  - MCORs can replace existing SCORs deployed in many areas at SLAC
- Free standing power supplies (15)
  - Can all be used as spares for LCLS

Power Supplies

- Experience from recent FFTB work
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- Rack mounted power supplies (401)
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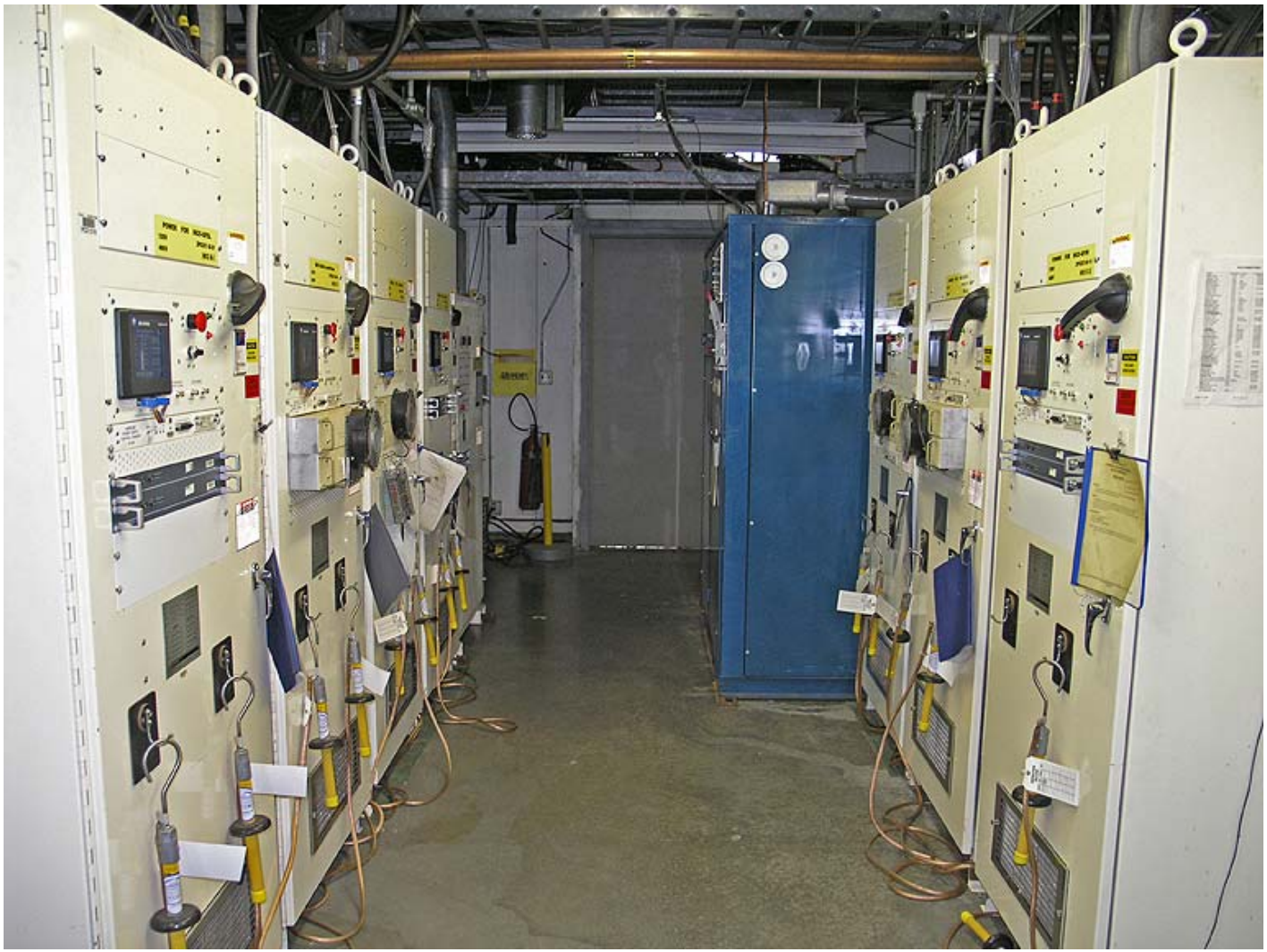
  - MCORs can replace existing SCORs deployed in many areas at SLAC
- Free standing power supplies (35)
  - Can all be used as spares for LCLS
- Estimated cost 955.2 k$

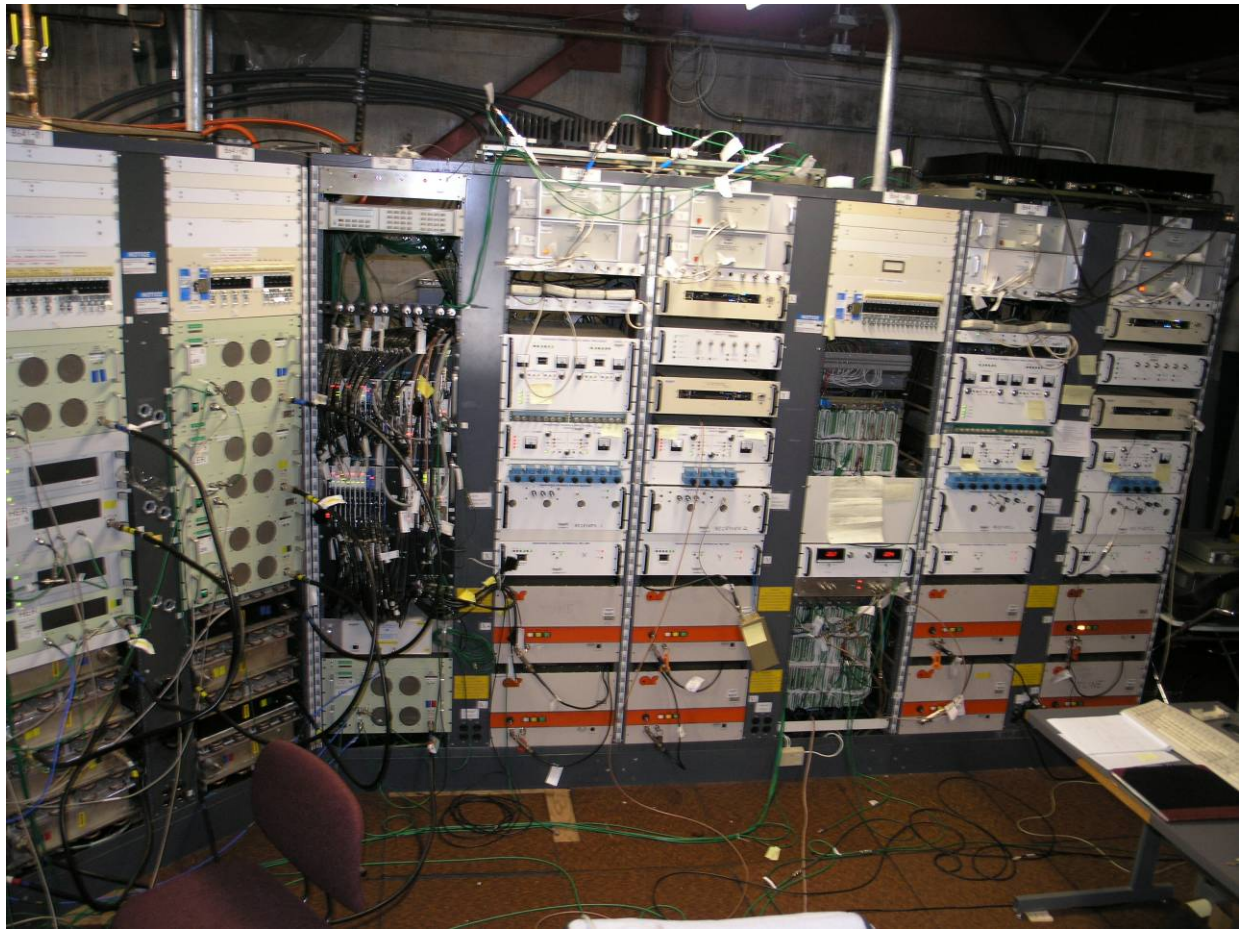


PPS Systems

- Beamline devices (stoppers, current monitors, …) to be preserved
- PPS keybanks to be recovered for use at other locations at SLAC

Feedback systems

- Beamline devices to be preserved
- Power amplifiers (10 @ 150 k$ ea. purchase price) should be preserved.
- Other system elements to be discarded
  - Technology has evolved
  - Components no longer available



Vacuum System Controls

- Most items have application at other projects at SLAC
  - Ion pump power supplies (188 total)
  - Vacuum gauge controllers (142 total)
  - Valve controllers (14 total)
  - Valve pneumatic panels (61 total)

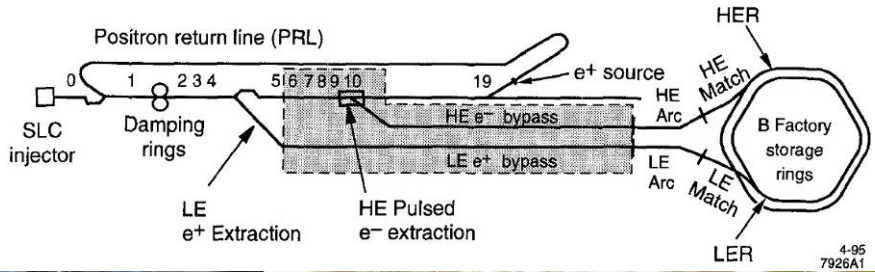
Computing/Controls/Network Infrastructure

- Equipment to be preserved as useful for other projects at SLAC
  - Wireless Access Points (~10)
  - Public switches (6)
  - VME crates (4)
  - VXI crates (15)
  - Allen Bradley (15)
  - GPIB (~5)
  - Solaris servers (3) and Linux servers (2)
- Accelerator switches are obsolete, but can be removed for a trade-in rebate (16)
- Alphas and RMX (eg. PR*) micros to be retired
- Voice trunk cabling goes through the tunnels to each IR hall. There will be a major impact to the **CEH voice trunk cables** (ties into the IR-2 hall) **and the Alpine Gate** (ties in the IR-4 hall).
- Fiber-optic cabling is routed through conduits not in the PEP tunnels and should not be impacted.
- Controls systems removal estimated cost 175.5 k$

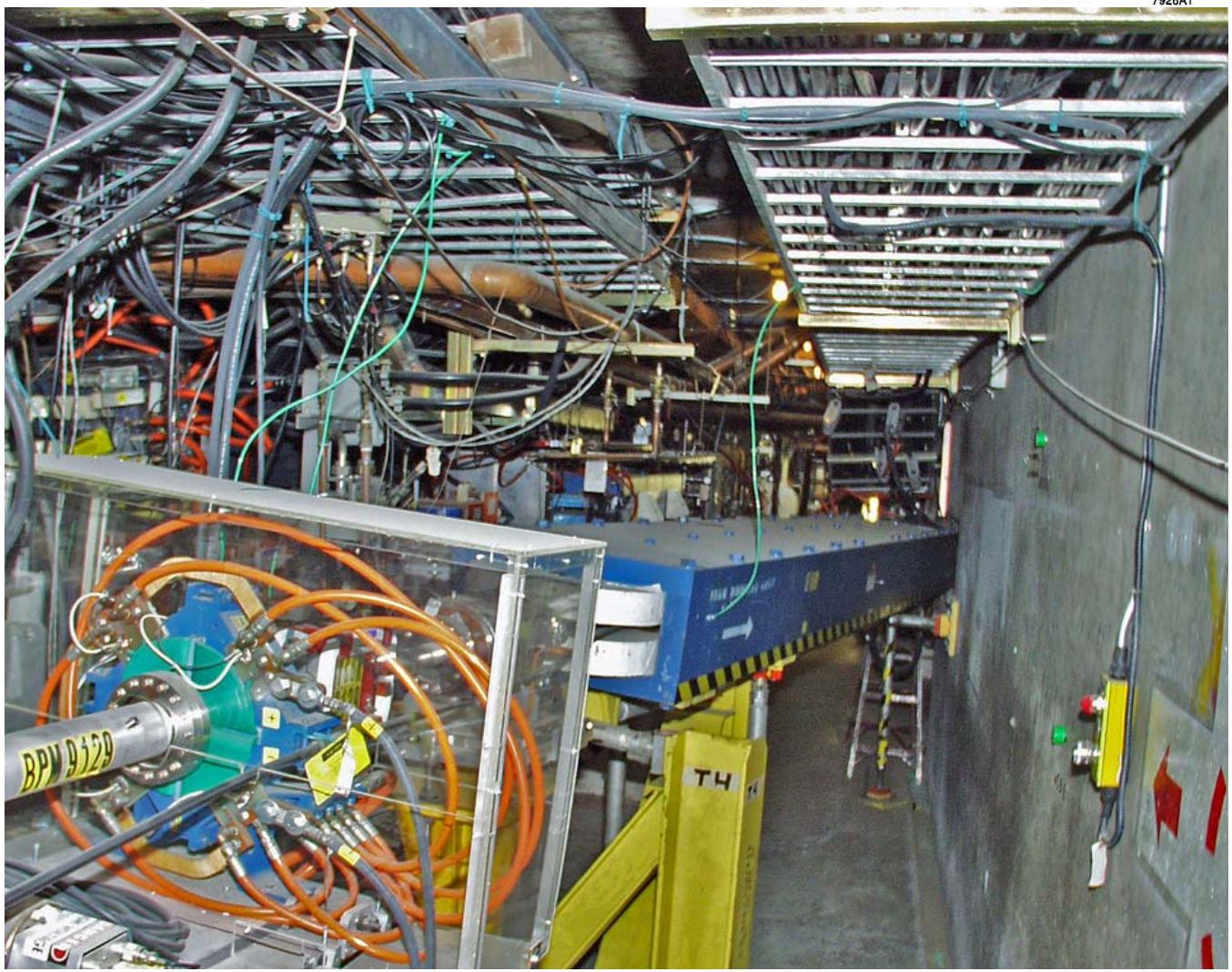
PEP Injection Lines

- Located in the Accelerator Housing
- Extract & transport e^- and e^+ from the accelerator to PEP
- Much lower equipment density than that found in the PEP rings
- e^- transport 7200 ft., e^+ transport 8500 ft.
  - NIT & SIT lines add ~730 ft to each line
- Existing drift tubes of up to 150 feet in length were assembled in place, will have to be cut to remove
- Magnets, BPMs, bellows, to be recovered
- In general, a single 9” x 9” cable tray to be removed
- **Transport lines could have use in other, non-PEP programs**

PEP Injection Complications



- Removal activities can only proceed when the Linac is not in operation
- Congestion increases where beamlines diverge an head to PEP
  - Equipment removal in this area has a high risk of collateral damage to accelerator components
- Beam switchyard (BSY) and Tune-Up Dumps present a radiological challenges
  - High radiation and contamination areas



Storage Space

- Existing PEP tunnel of 79,200 sq. ft. is filled with beamline components, cable trays, supports, & conventional services to a moderate density
- PEP support buildings house many racks of recoverable electronics and power supplies
- There will be a need for interim component disassembly space
- There will be a need for extended storage space for recovered components

Project Management

- Area Managers (3 F.T.E.)
- Technical System Managers
  - Power Conversion (2 F.T.E.)
  - RF System (1 F.T.E.)
  - Vacuum/Mechanical System (3 F.T.E.)
  - Controls Infrastructure (1 F.T.E)
- UTRs & Contractor management (15% of awarded contract value)
- Safety Oversight (6 F.T.E.)

Project Cost Summary

	PEP Rings	PEP-Injection	Total
Vac/Mech	3,310.2	1,003.5	4,313.8
Controls	131.9	43.6	175.5
RF Systems	1,656.1	0.0	1,656.1
Shielding Removal	217.0	0.0	217.0
Power Supplies	761.1	194.1	955.2
Cables & Cable Trays	14,526.0	2,663.1	17,189.1
Subtotal	**20,602.4**	**3,904.3**	**24,506.7**
Project Oversight			8,951.4
Subtotal			**33,458.2**
50% Contingency			16,729.1
Project total			**50,187.2**

Next steps

- Secure guidance on critical topics
  - Identify projects which could reuse surplus PEP equipment, verify interest with project management
  - Determine fate of PEP-Injection lines
  - Should project be optimized for cost? Duration? Non-interference with other programs?
  - Storage locations, disposal requirements
- Investigate technical systems further, identify components for reuse/spares
- Investigate cable removal numbers from FFTB experience. As projected, these represent 34% of the estimated costs to remove the PEP technical systems
- Prepare schedule including task dependencies
- Prepare project management tools (labels, travelers, EWPs, H&R Lift Plans, …)