Commissioning Plan for the ALS with Superbends

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- Introduction/Boundary Conditions for Scheduling
- Commissioning Team
- Milestones/Fall Back Plans
- Detailed Schedule
- Summary

Introduction

- Evaluated critical accelerator physics issues in advance $\Rightarrow$ will use known methods for commissioning
- Complete set of baseline measurements acquired in advance
- Have large team of accelerator physicists available, which covers all key abilities (enough for 3–4 shifts teams with $\geq$ 2 persons)
- Finish shutdown early (issue is weekend and holiday) to gain contingency time, add 3 day shutdown after 2 weeks of commissioning

Boundary Conditions for Scheduling

- Milestones are well defined and scheduled early enough; realistic fall-back scenarios are in place
- Schedule is based on two shifts a day, with automated measurements (operators) over night; plan is to extend shifts longer than 8 hours; some owl shifts can be used as contingency
- Time estimate for each task is realistic to pessimistic, but no explicit contingency in case of significant problems
- Contingency is included implicitly, only tasks up to #106 (first 11 days of scheduled tasks) are absolutely necessary
- Users are involved at several stages of commissioning (early enough)

Commissioning Team

- Shift organization:
  - Plan is to have at least two people on day and swing shift (plus operators).
  - Both shifts extended to maybe 10 hours (with overlap).
  - Daily progress meeting around shift change from day to swing shift.
- People available:
  - → Shift leaders (familiarity with ALS, measurement tools and control system/Matlab tools): Winfried Decking (DESY), David Robin, Christoph Steier, Ying Wu (Duke, last two weeks)
  - → Regular shift takers (wide spread knowledge base): Terry Byrne, Laurent Nadolski, Hiroshi Nishimura, Benoit Salvent, Fernando Sannibale, Tom Scarvie, Weishi Wan, Andi Wolski

Commissioning Team II

- → Specialists in non-Superbend tasks/systems; shift leaders for non-Superbend shifts: Walter Barry, John Byrd, Slawek Kwiatkowski, Greg Stover, Stefano de Santis
- → External experts: Ed Domning, Kem Robinson
- → Support from engineering: Superbend project team, controls group, mechanical engineering, electrical engineering
- → Operators (semi-automated/routine measurements, scrubbing, equipment startup/searches, operations checks)

⇒ Enough people available to fill owl shifts as well, if necessary.

Milestones

- New control system for corrector magnets and IDBPMs functional. (9/4)
- Realignment of the Superbends necessary? (9/7)
- Is the Superbend performance good enough to keep them in the ALS? (9/19)
- Sufficient progress in commissioning to fix date for 3-day shutdown (9/19)
- Ready for tests with users (and to define the scope of the tests) (9/28)

Definition of what results have to be achieved to go ahead after each milestone.

Fall-back plan and time necessary.

Milestones: Control System

Control System:

- Corrector magnets and IDBPMs are migrated to compact-PCI, preparation for fast orbit feedback (reviewed last year)
- Necessary to go ahead: Reliable control of corrector magnets and read-out of IDBPMs; sufficient data rates (necessary 2 Hz, better $\geq$10 Hz); stability of power supplies with new DACs as good as before (1×10^{-4}); noise of IDBPM readings as small as before ($0.3\mu m$ rms); digital averaging for IDBPMs with data rate $\geq$100 Hz (is needed one week later than the other items)
- Fall back solution: Switch corrector interface cables back to ILCs, plug cables leading to ILCs back onto IDBPMs, reconfigure database (overall at most 2 days)

Milestones: Superbend Realignment

Superbend Realignment:

- Magnets are aligned based on magnetic measurements, survey of the current position of all magnets on girders 4, 8 +12 and integration of particle trajectory through field → some possible error sources
- Necessary to go ahead: Stored beam; analysis of coupling, orbit measurements, gradient distribution indicates alignment is within tolerances; offset and angle of photon beams small enough to be accepted by user beamlines
- Fall back solution: Identify source of error and independently go ahead with realignment based on beam measurements (time necessary between 1 day - cryostat alignment and 5–7 days - cold mass alignment)

Milestones: Keep Superbends

Keep Superbends:

- The performance of the ALS with Superbends has to be good enough (orbit, stability, lifetime, current, injection efficiency) to keep the Superbends
- Necessary to go ahead: Superbends operate reliably; stored beam; orbit motion is small enough (below 1/10 of $\sigma_{x,y}$); dynamics studies go well (lifetime, injection efficiency); ramping to 1.9 GeV is possible
- Fall back solution: Reinstall gradient bend magnets, re-commission ALS without Superbends (conservative: 7 days for installation, 7 days for commissioning)

Decision about date for 3-day shutdown is coupled to this decision.

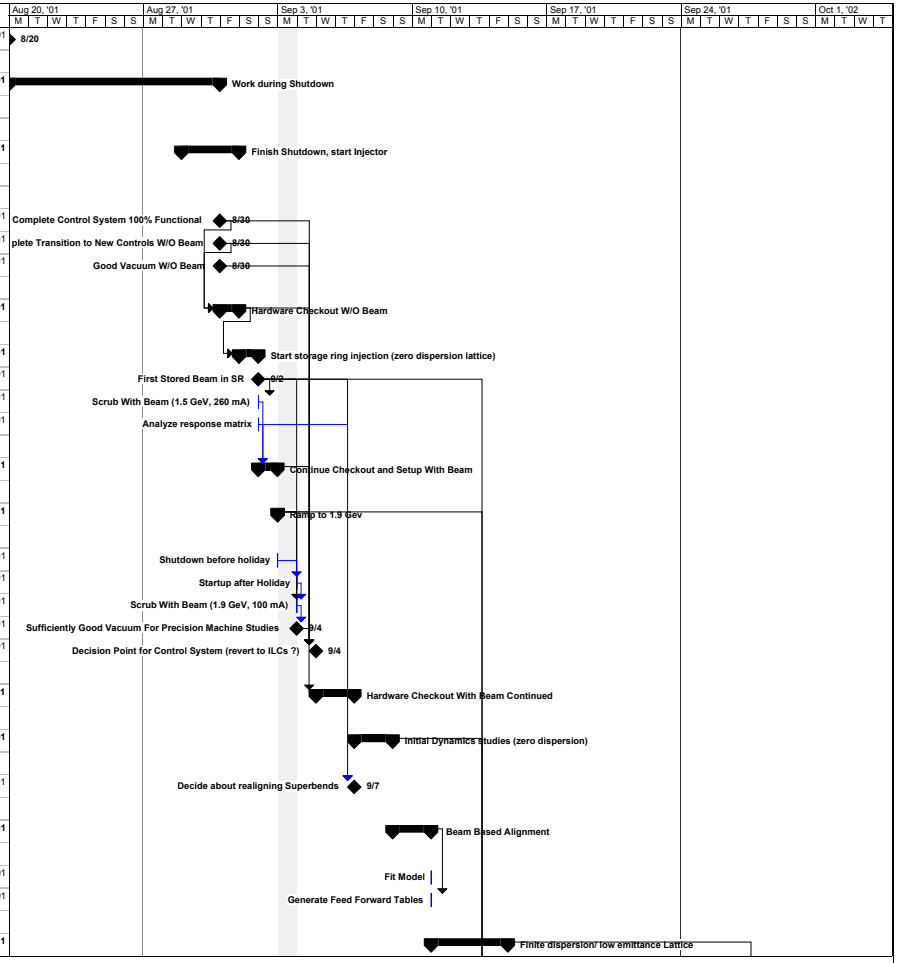
Milestones: Ready for user tests

Ready for user tests

- The Superbend installation and commissioning will bring many changes to beam properties and ALS operation; in addition, most ID beamlines will be realigned; therefore it is important to test the new conditions together with users.
- Need to go ahead: Finish commissioning; Have a complete set of information about what has changed.
- Fall back solution: Non optimum performance for first week(s) of user operation; continue optimization in collaboration with users into October.

Detailed Schedule I

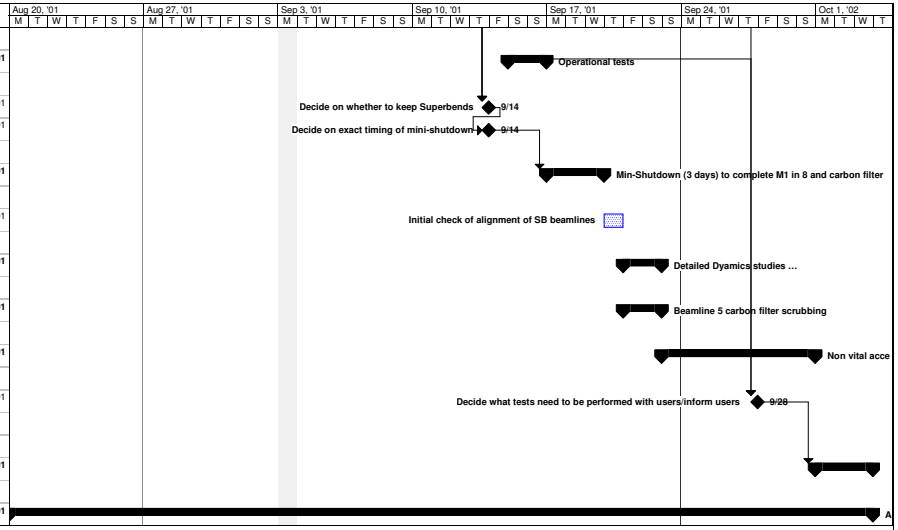
ID	Task Name	Duration	Start
1	Baseline Measurements (Power Supply, Orbit, Inj. ...)	0 days	Mon 8/20/01
2			
3	**Work during Shutdown**	**7.33 days**	**Mon 8/20/01**
7			
10			
11	**Finish Shutdown, start Injector**	**2.42 days**	**Tue 8/28/01**
18			
21			
22	Complete Control System 100% Functional	0 days	Thu 8/30/01
23	Complete Transition to New Controls W/O Beam	0 days	Thu 8/30/01
24	Good Vacuum W/O Beam	0 days	Thu 8/30/01
25			
26	**Hardware Checkout W/O Beam**	**0.67 days**	**Fri 8/31/01**
39			
40	**Start storage ring injection (zero dispersion lattice**	**0.67 days**	**Sat 9/1/01**
54	First Stored Beam in SR	0 days	Sun 9/2/01
55	Scrub With Beam (1.5 GeV, 260 mA)	8 ehrs	Sun 9/2/01
56	Analyze response matrix	8 ehrs	Sat 9/1/01
57			
58	**Continue Checkout and Setup With Beam**	**0.21 days**	**Sun 9/2/01**
62			
63	**Ramp to 1.9 Gev**	**0.25 days**	**Sun 9/2/01**
66			
67	Shutdown before holiday	1 ehr	Sun 9/2/01
68	Startup after Holiday	4 ehrs	Tue 9/4/01
69	Scrub With Beam (1.9 GeV, 100 mA)	4 ehrs	Tue 9/4/01
70	Sufficiently Good Vacuum For Precision Machine Stuc	0 days	Tue 9/4/01
71	Decision Point for Control System (revert to ILCs ?)	0 days	Tue 9/4/01
72			
73	**Hardware Checkout With Beam Continued**	**1.92 days**	**Tue 9/4/01**
87			
88	**Initial Dynamics studies (zero dispersion)**	**1 day**	**Fri 9/7/01**
92			
93	Decide about realigning Superbends	0 days	Fri 9/7/01
94			
95	**Beam Based Alignment**	**1.67 days**	**Sat 9/8/01**
102			
103	Fit Model	8 ehrs	Mon 9/10/01
104	Generate Feed Forward Tables	8 ehrs	Mon 9/10/01
105			
106	**Finite dispersion/ low emittance Lattice**	**2.17 days**	**Tue 9/11/01**



Page 1

Detailed Schedule II

ID	Task Name	Duration	Start
112			
113	**Operational tests**	**1.75 days**	**Fri 9/14/01**
119			
120	Decide on whether to keep Superbends	0 days	Fri 9/14/01
121	Decide on exact timing of mini-shutdown	0 days	Fri 9/14/01
122			
123	**Min-Shutdown (3 days) to complete M1 in 8 and ca**	**2 days**	**Mon 9/17/01**
127			
128	Initial check of alignment of SB beamlines	8 ehrs	Thu 9/20/01
129			
130	**Detailed Dyamics studies ...**	**1.67 days**	**Thu 9/20/01**
134			
135	**Beamline 5 carbon filter scrubbing**	**1.38 days**	**Thu 9/20/01**
139			
140	**Non vital accelerator physics studies**	**5.17 days**	**Sun 9/23/01**
149			
150	Decide what tests need to be performed with users/inf	0 days	Fri 9/28/01
151			
152			
153	**Operations tests with beamline scientists**	**3 days**	**Sun 9/30/01**
157			
158	**Align beamlines 4, 5, 7, 8, 12**	**30.29 days**	**Mon 8/20/01**



Summary

- We have put together a detailed commissioning plan which includes all necessary tests (based on prior commissioning experience) and involves users early enough.
- All methods needed for commissioning are in place and tested.
- Accelerator physics issues with high risk have been extensively studies in preparation with very positive results.
- Commissioning team is large enough and has necessary knowledge.
- Contingency is included implicitly into schedule and is in general larger than a factor of two.