



Detector Replan: Transition to Science Run

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Progress Against Schedule?

- Exciting technical progress on detector installation/commissioning
- However, a number of minor problems and delays:
 - » Start-up problems in seismic isolation production
 - » Adhesion problems for the magnet/standoff assembly to the optics
 - » Handling and fixture problems for completed suspension assemblies
 - » Loss of needed flourel components due to a tornado
 - » Re-baking of the seismic stack spring seats to mitigate water outgassing
 - » Number of secondary delays (not on critical path, but “just in time”)
- Work-arounds have minimized delays, but...
 - » **Detector commissioning is about 7 months behind schedule**



Original Installation and Commissioning Plan

- Original “plan” formulated in 1994
 - » Fab and install all three interferometers as rapidly as possible
 - » Commission them nearly simultaneously
 - » Single remaining milestone: Initiate coincidence testing – 12/00
- Suffers from two main weaknesses....
 - » By installing all three interferometers before beginning commissioning, any design deficiencies are replicated three times
 - Example: Suspension controllers
 - » Sequential installation and commissioning episodes do not use the range of skills of the LIGO staff as effectively as possible
- ...and one unnecessary constraint:
 - » To begin coincidence testing only after all three interferometers are operational, unduly drives the installation of the third interferometer



Reformulated Installation and Commissioning Plan

- Delay completion of the third interferometer (the Hanford 4km interferometer):
 - » Enable lessons learned from first two interferometers to be realized in redesign before installation (minimizes re-work/re-installation)
 - » Reduce simultaneous installation and commissioning workload on the LIGO lab staff
- Use the Hanford 2 km interferometer as a “pathfinder” to identify problems early
- Use the Livingston 4 km interferometer for problem resolution & detailed characterization
 - Example: Modecleaner servo characterization



Reformulated Installation and Commissioning Plan (continued)

- Initiate coincidence testing when the first two interferometers are at a useful strain sensitivity
 - » Redefinition of “Initiate coincidence testing” milestone from three interferometers to two
- Define clear decision points in the schedule for the third interferometer installation elements
 - » Perform all in-vacuum work and infrastructure as early as possible
 - » Delay installation of the servo-control electronics until we’ve gained enough experience to incorporate anticipated re-design
- Smoothest path to successful Science Run



LIGO I Science Run

- Begins with reliable and calibrated coincidence data on three interferometers and stable configuration
 - » Not triggered by specific sensitivity number
 - » Early coincidence data for testing analysis techniques and software
 - » Involvement of LSC in detector characterization and data analysis
- Data runs to be alternated with improvements to reach design goals in sensitivity and reliability
- Commitment to acquire at least one year of integrated data at $h \sim 10^{-21}$ before initiating LIGO II



On-site Participation of LSC in LIGO I

- What marks transition from fabrication to research?
 - » Not clearly defined in Cooperative Agreement
- Enables non-LIGO Lab groups in LSC to participate in research in detector characterization
 - » Strengthen effort to achieve full sensitivity
 - » Provide training and “real-interferometer” experience for LSC
- Propose that individual detectors become available for LSC research (subject to LIGO Lab scheduling and configuration control) **when:**
 - » “Final” hardware configuration installed (no kludges)
 - » Gross electronic and mechanical deficiencies fixed (oscillations, line spikes, rubbing, ...)
 - » Locks for long enough times to make meaningful measurements



Top Level Schedule

ID	Task Name	1998			1999				2000				2001				2002			
		Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	LHO 2km IFO	[Timeline bar from Q2 1998 to Q4 2001]																		
14	LLO 4km IFO				[Timeline bar from Q1 1999 to Q4 2001]															
30	LHO 4km IFO	[Timeline bar from Q2 1998 to Q4 2001]																		
44	Coincidence Engineering Run starts																			
45	Observatory Operations & improvements																			
46	Science Run starts																			

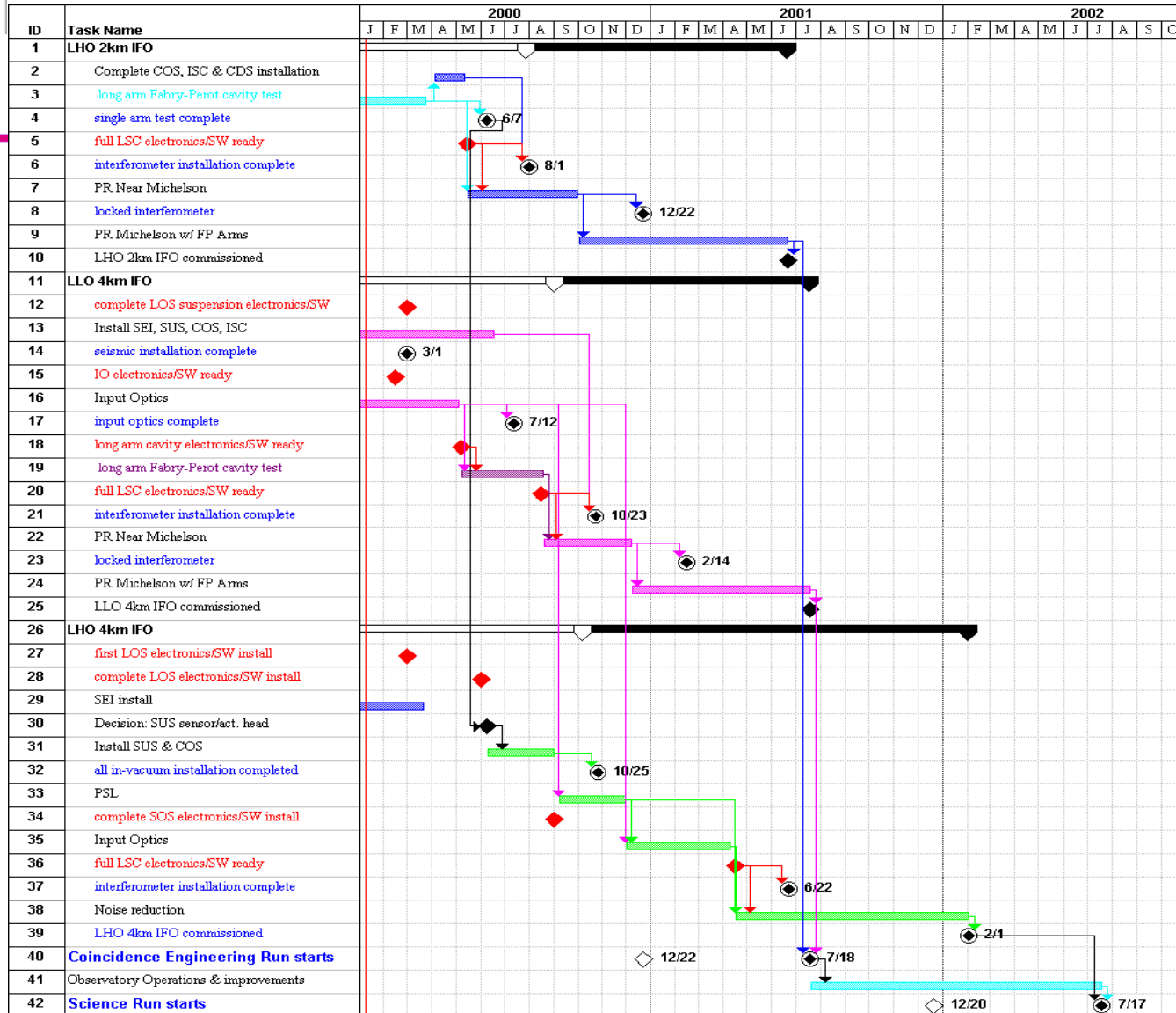


Projected Significant Events

Hanford 2km interferometer	Seismic isolation installed Input Optics completed Single arm test complete Interferometer installed Interferometer locked	done done done 8/00 12/00
Livingston 4km interferometer	Seismic isolation installed Input Optics completed Interferometer installed Interferometer locked	done 7/00 10/00 2/01
Coincidence Engineering Run (Hanford 2km & Livingston 4km)	Initiate Complete	7/01 7/02
Hanford 4km interferometer	Seismic isolation installed All in-vacuum components installed interferometer installed interferometer locked	done 10/00 6/01 8/01
LIGO I Science Run (3 interferometers)	Initiate Complete (obtain 1 yr @ $h \sim 10^{-21}$)	7/02 1/05



Revised Schedule





Summary

- **Installation & Commissioning successes!**
 - » Two Mode Cleaners aligned and locked
 - » The 2km long arm cavity test completed last month (Lock durations up to 10 hours!)
 - » Have operated essentially all key pieces of full interferometer (separately)
- **Delays have caused us to replan Installation & Commissioning**
 - » 7 month delay due to installation problems on the critical path
 - » More effective plan for installation and commissioning
 - Redefinition of “Initiate coincidence testing” milestone
- **New plan ensures a smooth transition into Science Run**