
# Introductory Remarks to LIGO II Systems Meeting

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# Goals of the Meeting from Peter

- Review the current conceptual design and feasibility of each subsystem, including evaluating for each:
  - » major technical challenges
  - » fallbacks
  - » testing
- Review sensitivity goal. Can we (or how do we) come up with a sensitivity curve(s) that will stand as the requirement for LIGO II?
- Give definition to the systems requirements document:
  - » - what should be in it, and when?


# Goals from Me...

I think the most important thing to accomplish is to look at the top level sensitivity and noise goals for LIGO II from the White Paper, and the reference design that we described, and to reexamine these in the light of what we know now about thermal noise contributions, configurations, sapphire, thermal compensation. My assumption is that we will know the isolation system choice at this meeting. Given this perspective, we should exit the meeting with a commitment to the same or revised sensitivity goals, and we should have reexamined, in a gross sense, our R&D program to see if the overall schedule for development is credible in light of the new or reaffirmed goals. We should also exit the meeting with an understanding of the scope of the draft System Design Requirements Document to be prepared after that meeting (recognizing that iteration, even nonperturbative iteration may follow).


# ...Goals from Me

I would like to contribute to the opening of this meeting with some comments (why LIGO II in 2005, why a big or little step, options that I see, how to use the test interferometers, why DRD's need to be drafted before submitting a proposal,...) I will try to circulate these before the meeting so I don't put any surprises on the table (though there are none for those who have listened to me). I think that Peter and Ken should then go through the list of more detailed issues (like the issue raised by Ken recently in which he pointed out how the sapphire absorption and thermal response may broaden the set of configurations to be considered).


# Why LIGO II in 2005?

- We are here to directly observe gravitational waves
- "Conventional wisdom" says that these will be observed only when we reach LIGO II sensitivity
  - » all discussion assumes no discovery in LIGO I Science Run
- Running LIGO I much longer than through 2004 is incrementally a poor deal
  - » builds detailed competence
  - » builds refined technical base
  - » provides opportunity to learn networked analysis with other instruments
  - » searches for nearby strong transients
  - » But day for day search does not reach further


# Why a Big or Little Step

- human and material cost of upgrades
- missed opportunity for observing
- integrated system relationship of particular aspects of upgrades
- loss of support base interest
- very attractive step needed to get support


# Options (To Generate Debate)

- LIGO II IFO 1 <-- a --> LIGO II IFO 2 <-- b --> LIGO II IFO 3
  - a = interval between start of installation in vacuum system of first interferometer and start of same for second upgraded interferometer
  - b = start-to-start interval between second and third interferometer installation in vacuum
  - $0 \leq a \leq 24$ months
  - $0 \leq b \leq \infty$
- (a,b) = (0,0) option was presented conceptually last fall
  - absurd but a curiosity
  - this scenario should be planned for this year's submission as an exercise
- I suggest that the submission this year adopt
  - Start with one 4K (LLO ?)
  - a = 24 months
  - Replace LHO 4K first and 2K at same time or delayed
  - b = 0 to 6 months (but I hope that b can be made $\infty$
- The LHO 2K may need to be the LIGO III test interferometer
  - When might we decide not to upgrade the third interferometer?


# International Array

- If we take down one LIGO site, we need to plan to operate other site with Virgo also running
  - » other interferometers play role as well
- I intend to raise this at the July GWIC meeting
- We cannot expect Virgo, TAMA or GEO to agree to a specific running schedule now
- So there is a major schedule option built into our plan, or the international GW search perspective that will not be resolved until much later


# Core Optics Fallback

- Sapphire is essential for performance
- If sapphire development takes longer, silica input test masses could be used in first upgraded interferometer
- Sapphire put in after interval b is fallback plan


# Test Interferometers

- LASTI does full systems test of isolation system (SEI + SUS) with no attempt at heroic sensitivity
- GEO 10 Meter does signal tuned tests as planned
  - » encourage controls electronics technology exchange
- 40 Meter does straightforward signal tuned engineering test with:
  - » LIGO II electronics first articles
  - » double pendulum version of GEO suspension
  - » active isolation of sensitive optics
  - » no attempt at heroic sensitivity
- TNI does direct thermal noise test of:
  - » steel/silica --> steel/sapphire
  - » silica/sapphire only if possible
  - » no attempt at heroic sensitivity
- I am accepting more risk in thermal noise then I was proposing at Aspen and LSC meeting --> risk transferred to first upgrade


# Design Requirements Documents: When ?

- We need many of them developed by September to support proposal and system tradeoffs when we are reviewed
- TBD's (even major ones) allowed
- In 2001, we will plan an update of all of them (perhaps as part of Preliminary Design)


# LIGO II: The Name

- We have to sell LIGO II in Washington
- If LIGO I observes gravitational waves early on, the name LIGO II sells the gloss of LIGO I
- In the absence of an observation, or even before we have a chance to detect GW, the name LIGO II sells more like a sequel to an unreleased movie
- At August LSC meeting, we might try to adopt a jazzy name.


# LIGO I vs. LIGO II in the LIGO Lab

- Priority of:
  - » LIGO I commissioning
  - » LIGO II proposal
  - » LIGO Lab Operations Renewal Proposal

must be equal during the next year.

- We have to succeed at all three activities
- This will require developing newer members of team, relying on LSC collaborators, reducing attention to other activities


# Goals

- LIGO II must have a high likelihood of observing GW according to the conventional wisdom
- It must be an exciting and bold experimental advance
- Do these statements already tell us what the sensitivity curves must be?
- NSF perspective based upon my recent discussions
- Stan's perspective - "You are not ready for LIGO II."