Top level options: operating modes (broad vs. narrow band)

- Assumption: no detections in LIGO I, so broad-band is response most likely to 'net' a signal
- broadband signal recycling or just broadband (phasing of improvements?)
  - » ITM T 1% or 3%? Consistent with both modes?
- can we get deep holes in the sensing-limited response given sapphire noise?
- technical threshold for all response curves in each interferometer
  - » requires new technology (variable output coupler) for one design to be good for both narrow- and broad-band
  - » trade number of interferometers against complexity of individual ifos

Number of interferometers

- statistics of LIGO I will decide the value of 3 identical ifos in LIGO II
  - » no interest in simple 1/2 length additional interferometer
- astrophysical arguments
  - » have broad-band initial detection and then narrow-band tracking?
  - » Would one tuned ifo be enough fo a detection?
    - – Both confidence and #DOF measured are issues
  - » Periodic sources: narrow-band only needed for HF sources
- cost
- improvement timing
  - » LHO, LLO, then LHO? 2k or 4k LHO first? (Gary later)
  - » need for continuous observations

How to set overall noise requirement

- difficult to believe that astrophysical source models should drive design very hard
  - » inspiral:curves of many forms give similar seeing distances
  - » stochastic: thermoelastic acts as ‘cutoff’ (steeper than structural damping)
  - » HF narrow-band searches: argues for sapphire
- so: best technical effort, point of diminishing returns
  - » realize best thermal noise and thermal management for given materials
  - » infamous LF cutoff: is 10 Hz right? Check suspension noise
  - » RMS motion (displacement, velocity): grail of adiabatic passage through resonances (~1 nm/sec)
  - » HF cutoff: lots of work to get noise down at 7 kHz
    - – lots of data 'no-one' wants
    - – 1 kHz? 2?
- Secondary noises at 1/10 Principal noise sources: naive
  - » want some cost function having to do with difficulty of achieving

Process

- Choose improvement phasing; choose key technologies
- establish ‘cost’ functions for internal thermal noise and quantum noise
- perform trade
- adopt optimistic suspension parameters, then choose seismic cutoff
- form sensing and servo model, collect input data (feasible RMS spectrum)
- flow down secondary noise sources, actuator authority
- add 10%