

Seismic Isolation Requirements for LIGO II

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LIGO G000012-00-R

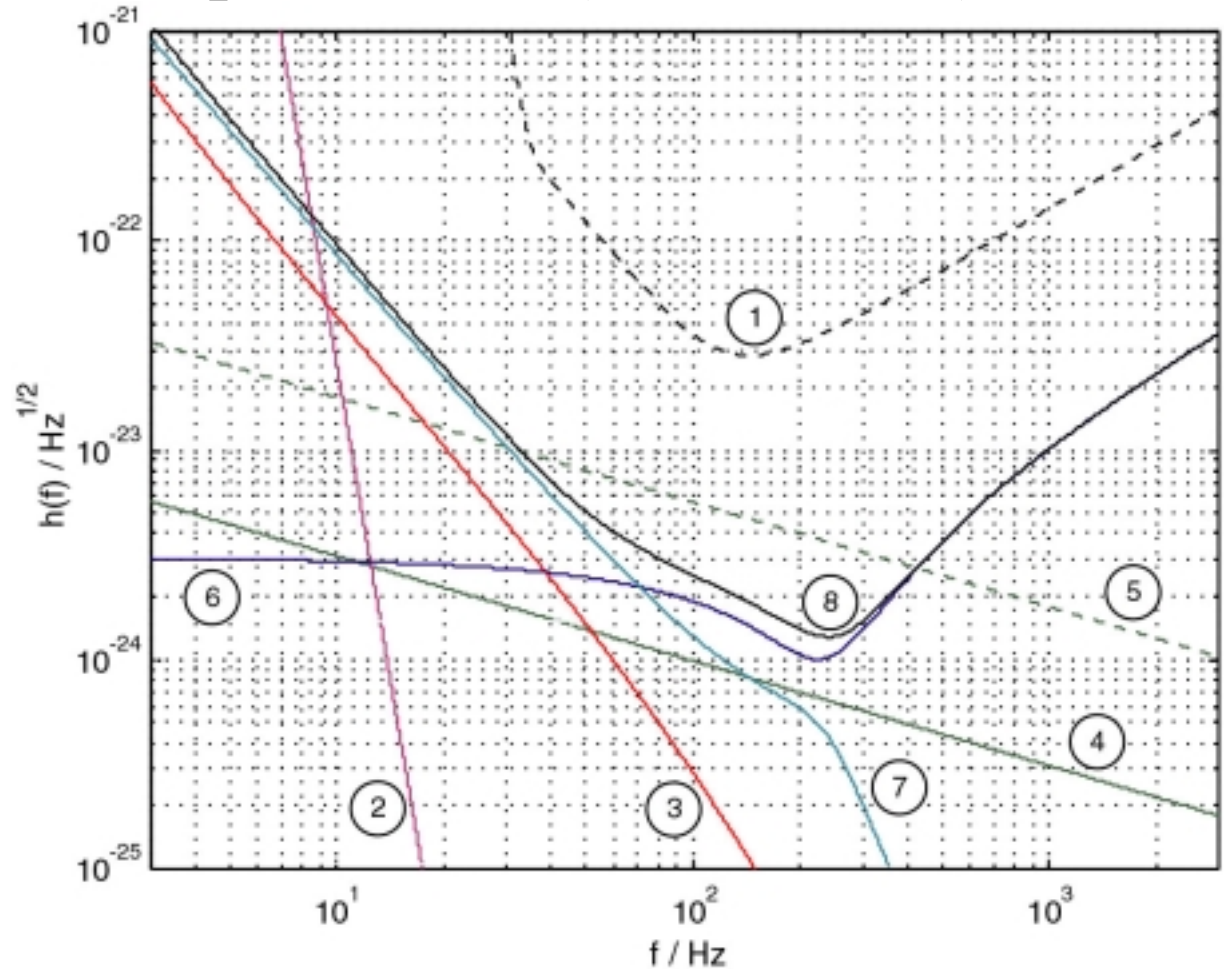
- Introduction to the two talks that follow
- Want to give a notion of the constraints and demands the LIGO II design puts on any solution for seismic isolation
- Point of departure:
 - The suspension is the hard part
 - allow its design to establish interface to isolation system

Basic top-level requirements

- strict vacuum compatibility
- system to fit in present vacuum envelope
- present seismic isolation support piers to be used
- suspension as proposed by GEO SUSpension group
 - suspension and isolation considered separate subsystems
- systems required for both HAM and BSC chambers
 - isolation requirements similar (30 more lax for HAM, less isolation from forcibly shorter suspension)
- multiple optics, telescopes, etc. per chamber
 - two multiple suspensions plus aux. Optics in BSC
 - many optics on the HAM optics table
- some flexibility in placement of optics required
 - ‘Schnupp’ asymmetry, finding sweet spots

(draft) Motion requirements (at test mass)

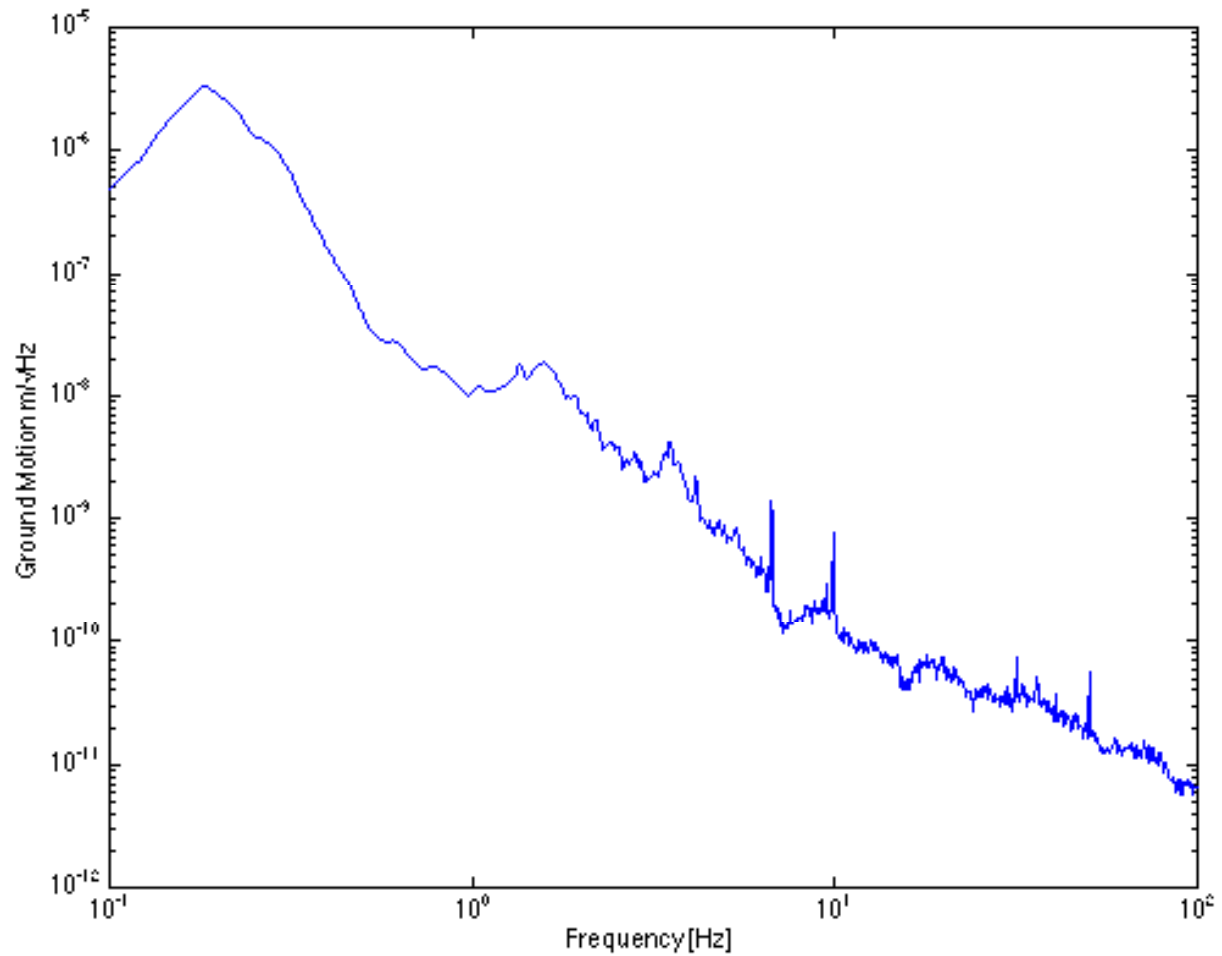
- 10^{-19} m/rHz at 10 Hz for Test Masses
- $1e-9$ m/sec
- 3×10^{-18} m/rHz at 10 Hz for Mode Cleaner
- 1 cm motion to compensate tides
- all internal modes damped
- limited drift etc.
- NB: suspension provides $>10^{-6}$ transmission at 10 Hz



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|-------------------------------------|--|
| 1 LIGO I total | 5 Internal thermal noise - fused silica (fallback) |
| 2 Filtered seismic noise | 6 Shot noise |
| 3 Suspension thermal noise | 7 Radiation pressure noise |
| 4 Internal thermal noise - sapphire | 8 LIGO II total |

Ground noise

- Livingston site spectrum
- May not have 'worst case' correctly represented
- Measurements underway...



Decisions, decisions

- Appears that both designs are basically capable of meeting requirements
 - (one last time:) An embarrassment of riches
- Neither approach quite in a state to best judge which will be ‘best’
- Set of criteria established, group of advisors to help evaluate
- Plan to select an approach in April

- Meanwhile, very nice research at breakneck pace.