

Thermal Noise in the Suspension

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Peter F.'s rubric, plus ...

- Current conceptual design
- Major technical challenges
- Fallbacks
- Testing

and, in addition,

- biggest worries

Suspension Conceptual Design

- Multiple pendulum with fused silica ribbons
- 4 wires to test mass, most (almost all?) control from upper masses
- nearly pristine test mass (no magnets!)
- A crude idea of this has always been a top priority for first upgrade
- GEO leadership in design, testing

Technical Challenges

(Thermal Noise considerations only)

- Ribbon fabrication, incl. attachment, twist
- Ribbon dynamics
- Excess loss
 - at ends, attachments
 - mystery losses (e.g., tension dependent loss?)
- Manufacturability
 - cleanliness, handling, strength, uniformity
 - assembly and repair

Fallbacks

Fused silica (round) fibers instead of ribbons

- penalty of order $\times 2$ in noise at low freqs
- a better developed technology with lower risks, simpler dynamics
- still have challenges of excess loss, some manufacturability issues

Testing Issues

- Measurement of thermal (or excess!) noise
 - VIRGO Low Frequency Facility
 - large interferometers (VIRGO?)
- Measurement of Q or f (*vs.* f , ideally)
 - of materials, parts, and systems
 - domain of small labs

My biggest worries

- Mild
 - Ribbon dynamics
 - Cleanliness, handling, strength, uniformity
 - Mystery losses
 - Creep noise