

The Thermal Noise Interferometer

Measuring Displacement Noise in Advanced Suspended Interferometers

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Objectives:

▶ Characterize Advanced Detectors

Verify Design Specifications

Measure Noise Spectrum

Measure Non-thermal Noise Properties

▶ Examine Physics

Noise Physics, Statistics

Reach (and Exceed) the SQL



LIGO-G000127-00-D

TNI Design Elements

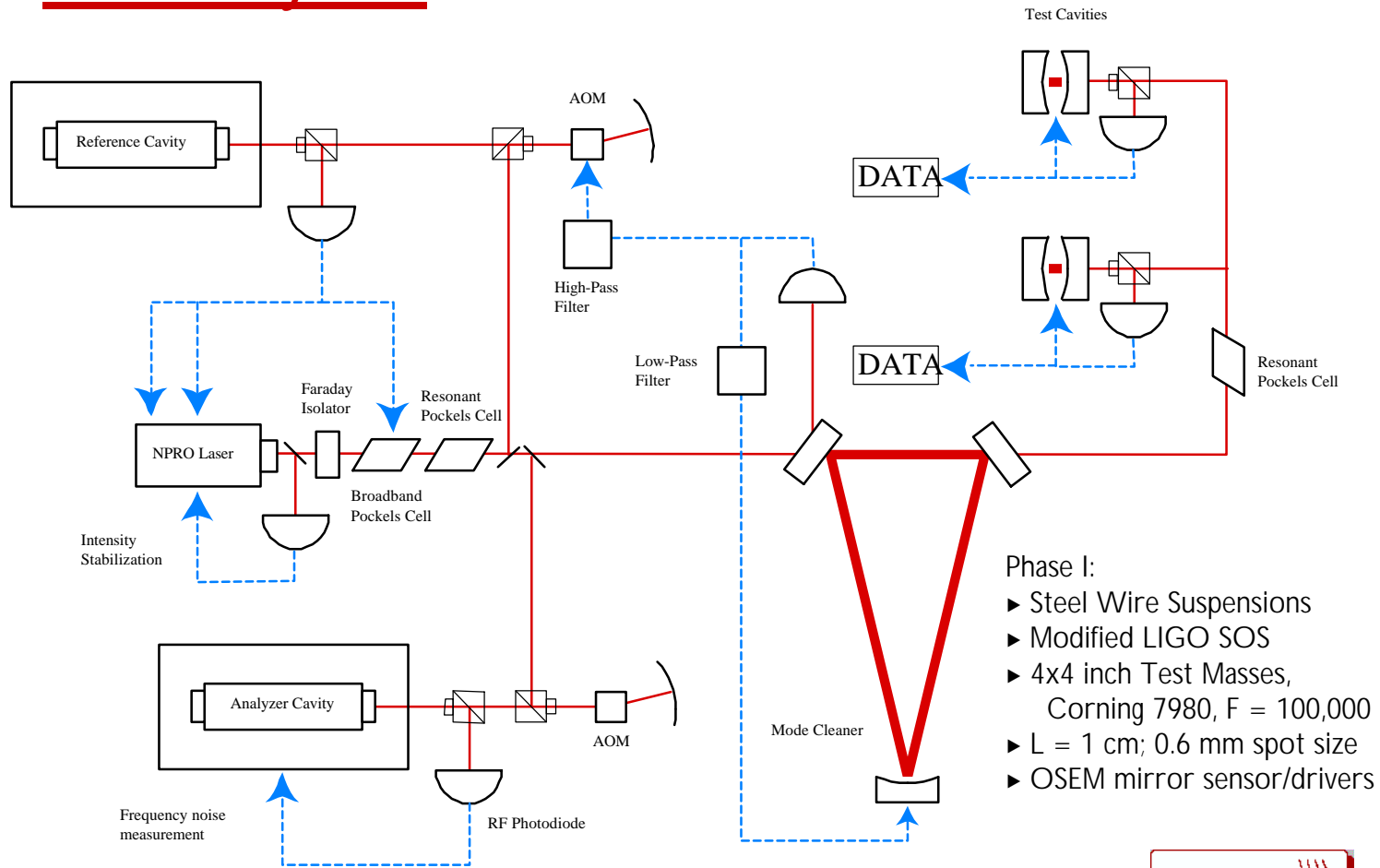
The many advantages of using a short cavity length ($L \approx 1\text{cm}$)

- ▶ Short Cavity Storage Time
 - ⇒ Use High Finesse Cavities
 - ⇒ No Power Recycling
- ▶ Independent Cavities
 - ⇒ No Recombination
 - ⇒ Independent Controls
- ▶ Reduced Optical Pointing Requirements - no WFS
- ▶ Reduced Laser Stability Requirements
- ▶ Common Support for Test Masses
 - ⇒ Reduced Seismic Noise
 - ⇒ Lower Suspension Recoil Thermal Noise

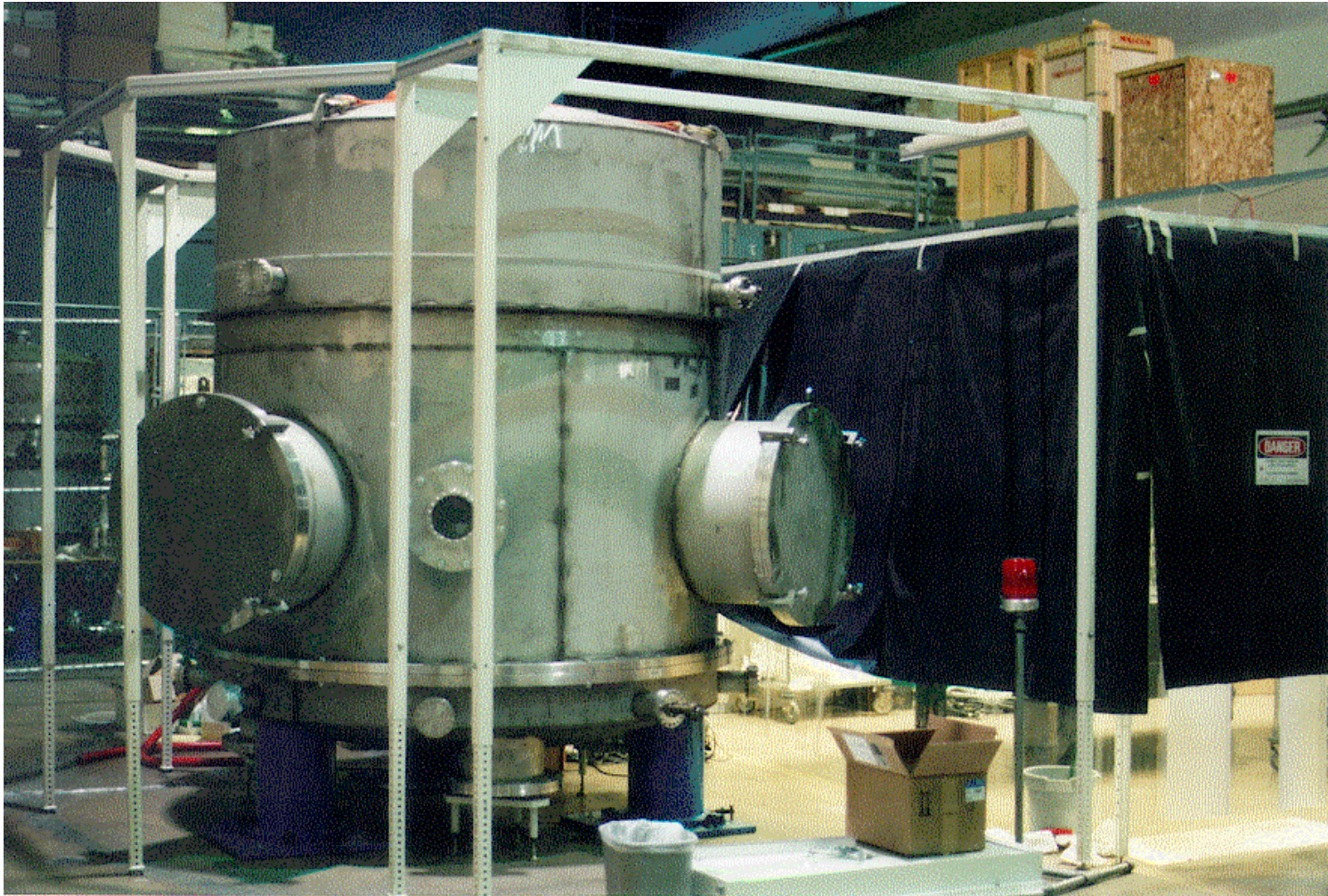
But...Smaller laser spot size ⇒ Higher Internal Thermal Noise



TNI Layout

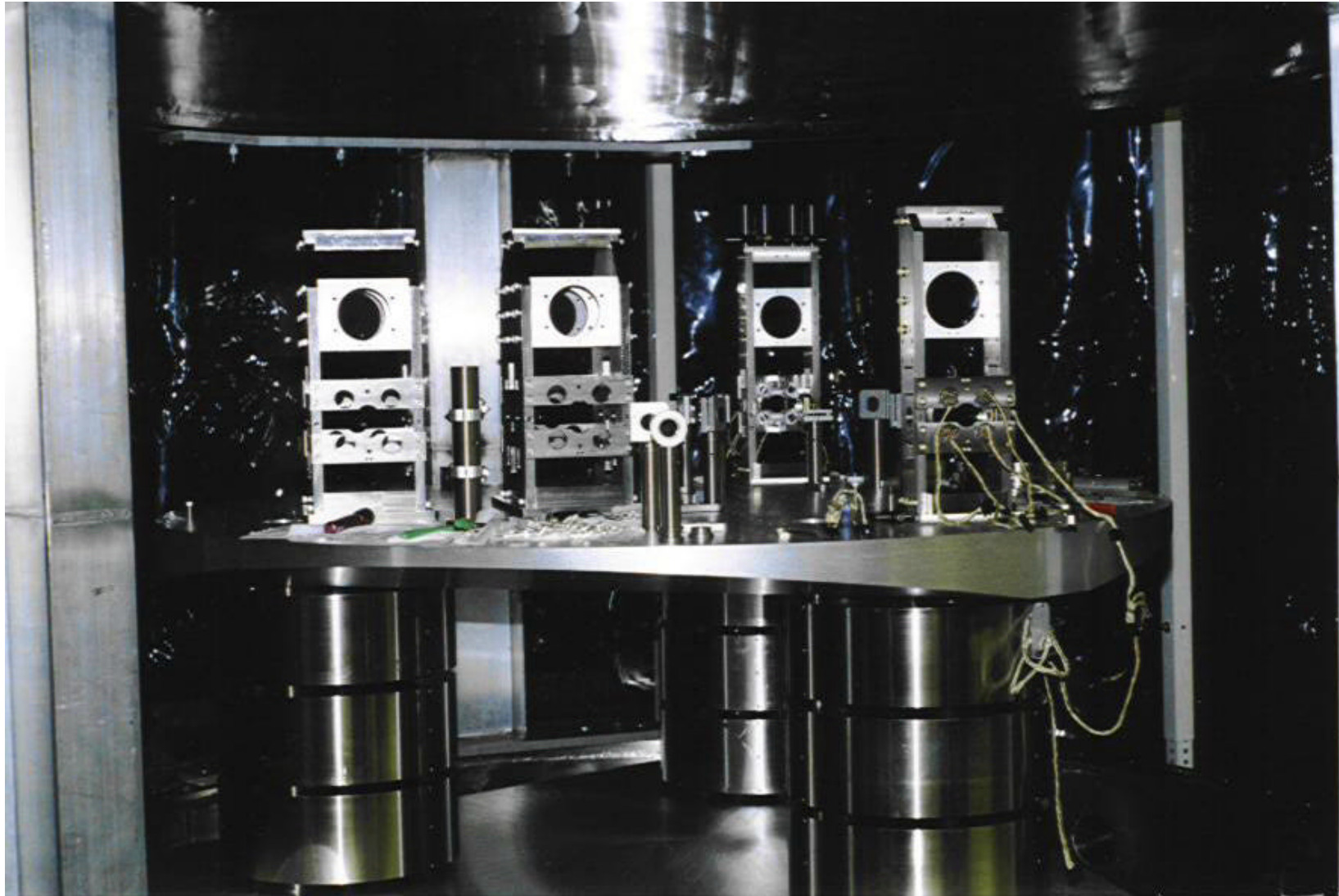


TNI Outside View

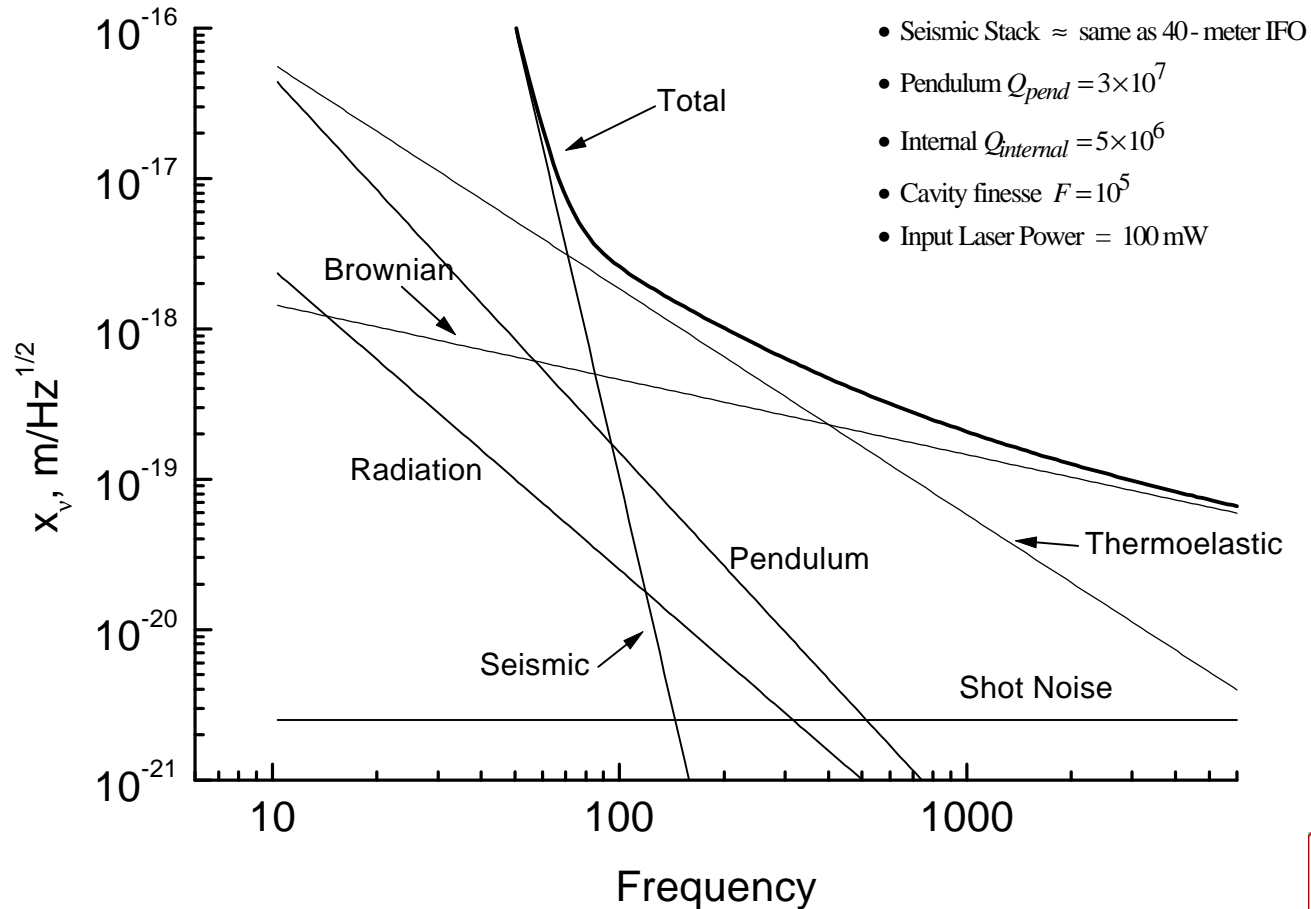


...before clean-room cover around vacuum chamber

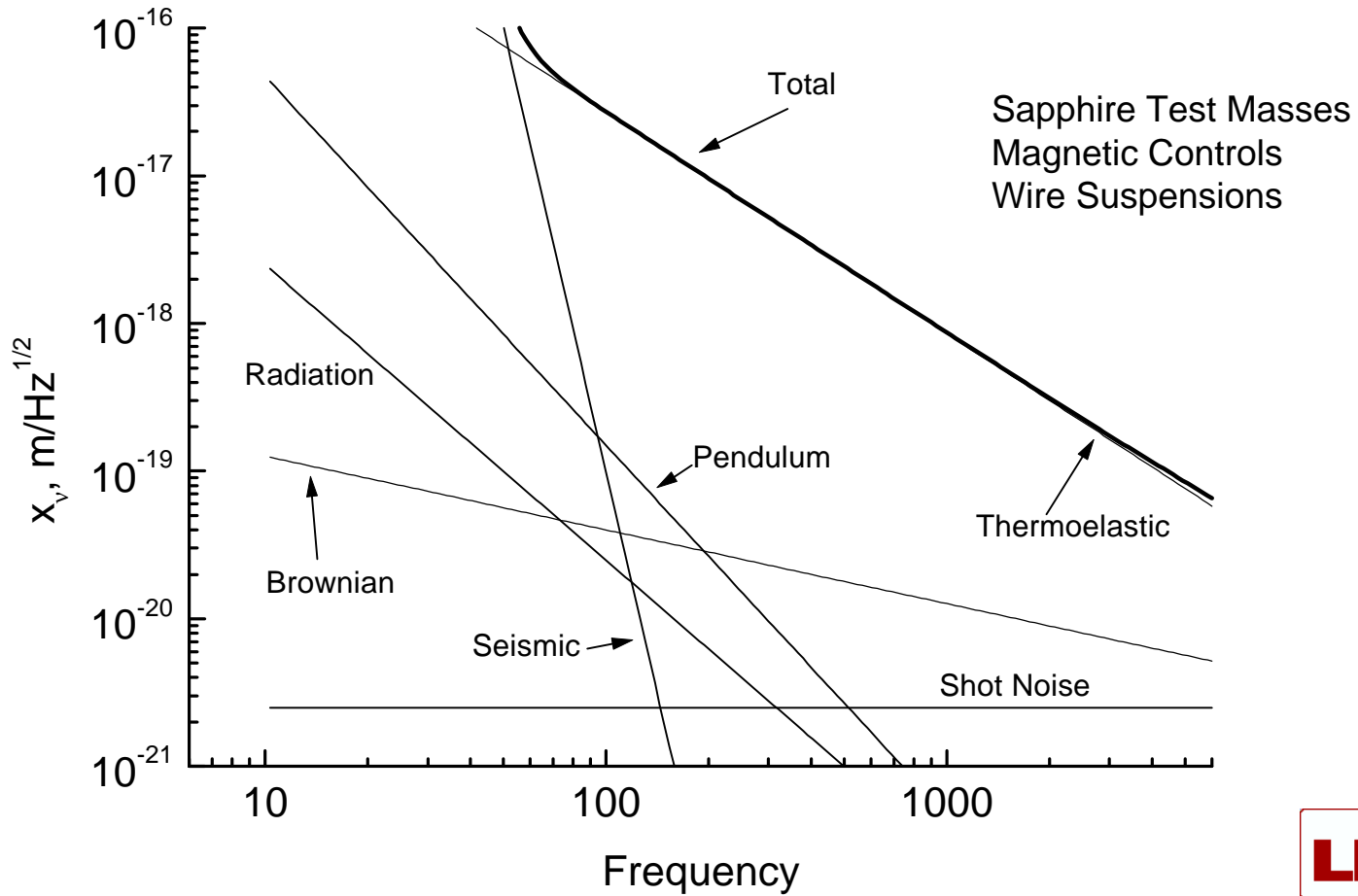
TNI View inside vacuum chamber



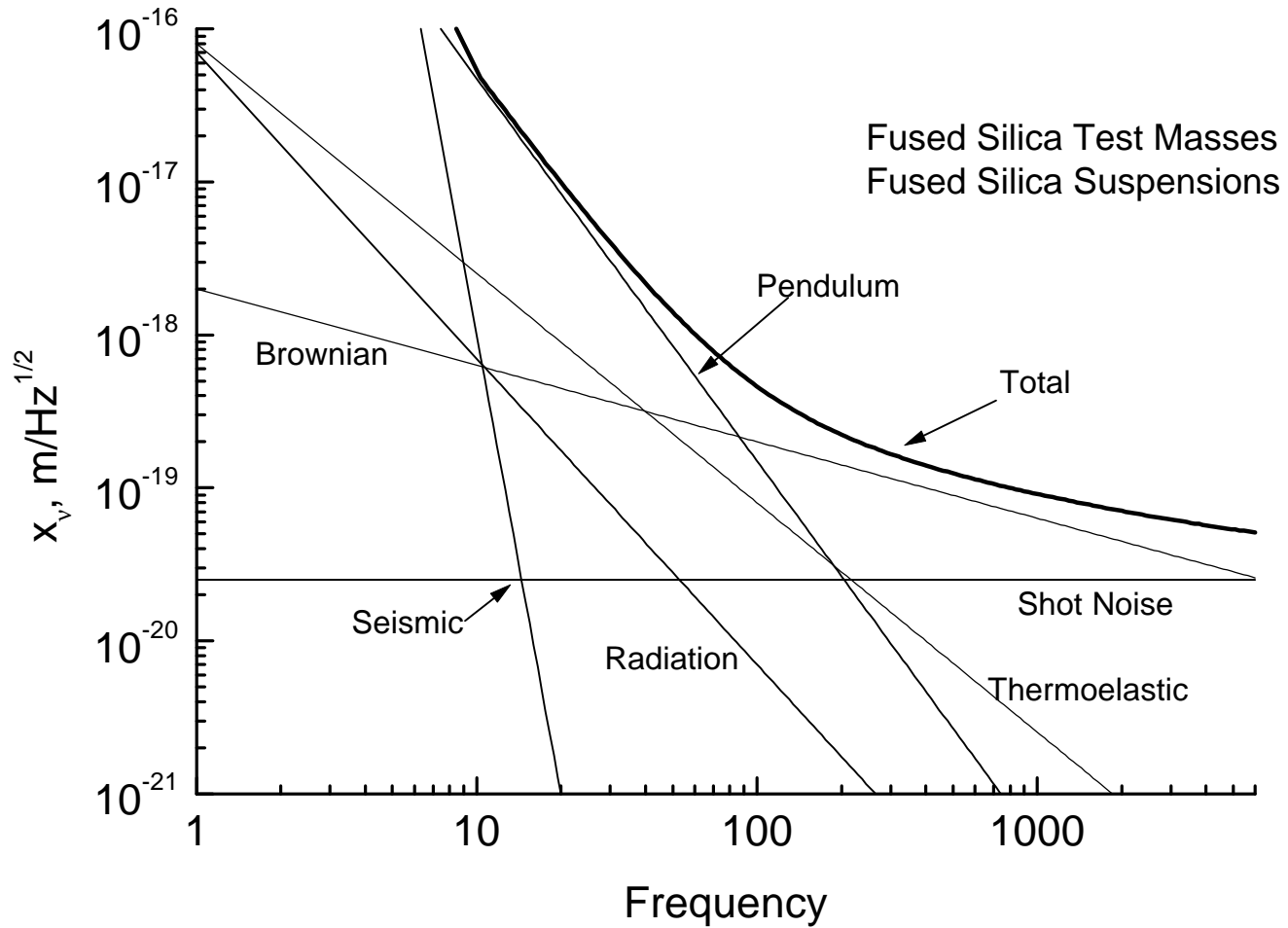
TNI Phase I Expected Spectrum



TNI Phase II Expected Spectrum



TNI Phase III (?) Expected Spectrum



PhotoThermal Noise Measurement

