



Thermal Noise Interferometer (TNI)

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Current status

- Been taking data since 12/01.
- Currently using Fused Silica Mirrors.
- South Arm Cavity has been close to design sensitivity. North Cavity noisier.
- Recent focus on improving reliability, noise in North Arm Cavity.
- Daytime operation with fast lock acquisition recently achieved.
- Noise, laser power recently balanced between arm cavities.
- South cavity noise degraded after balancing.

Plans for 2003

- Fused Silica:
 - » Measure coating thermal noise, net thermal noise for low- and high-Q substrates.
- Sapphire:
 - » Measure thermal noise (Braginsky noise?) in sapphire, report to downselect committee.
- Non-Gaussian noise:
 - » Measure non-Gaussian noise in fused silica, sapphire if time permits. (May be suspension dominated.)
- Quantify fundamental *and technical* noise sources.
- Quantify photothermal effect in coatings.

Technical Risks and Opportunities

- Low noise is hard!
 - » Shot noise below $1\text{e-}19\text{m}/\sqrt{\text{Hz}}$ requires precise alignment, good visibility.
 - » Best configuration for scattered light difficult to reproduce. (This means we don't yet understand it.)
 - » Electronic crosstalk sporadically problematic. Electronic noise does not necessarily always go down when we change a module!
- What unknowns are waiting for us in sapphire?
- Opportunity: Seismic retrofit to measure suspension thermal noise? (Probably later than 2003.)
- Opportunity: May find and quantify noise sources relevant to LIGO-I.

Schedule issues

- Initial noise levels have been better than expected.
- Further noise reduction slower than expected.
- Initial lock-acquisition was *much* more difficult than expected.
- Changes in downselect date compensate for schedule slips.

Cost baseline and issues

- All planned hardware already acquired. We are now in “science mode.”
- Further upgrades must be purchased as needs, dominant noise sources are identified.
- Electronics: miscellaneous upgrades. (estimate 20k\$ -- some from cds?)
- Computing/data acquisition for non-Gaussian work. (<6k\$)
- Optics: miscellaneous expansions and upgrades from vendor stock. No custom items planned for 2003. (estimate 15k\$)

Staffing baseline and issues

- Faculty:
 - » Ken Libbrecht (1/6 salary, time greater)
 - » Seiji Kawamura (visitor, ~1/4 time)
- Staff:
 - » Eric Black (1/3 salary, time greater)
- Graduate Student:
 - » Shanti Rao (1/1 salary, photothermal exp.)
- Undergraduates (all SURF, possible future returns):
 - » Kyle Barbary
 - » Adam Bushmaker
 - » Fumiko Kawazoe
 - » Sharon Meidt