LIGO

Status of Commissioning at LLO

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Overview

- Review of LLO interferometer status
- Pre-Stabilized Laser
- Mode Cleaner
- Near Michelson Alignment
- Operations
- Future

Detector Status

- Pre-Stabilized laser installed and operational since 09/99
- Mode Cleaner installed 02/00 and operational until 06/00
  - Re-installed 08/00 and now operational
- All in vacuum optical components installed and aligned since 11/00
  - Some optical tables need final positioning and alignment
- LSC electronics not yet fully installed
- Vacuum system almost ready for one arm tests
  - Small leaks may need to be eventually addressed

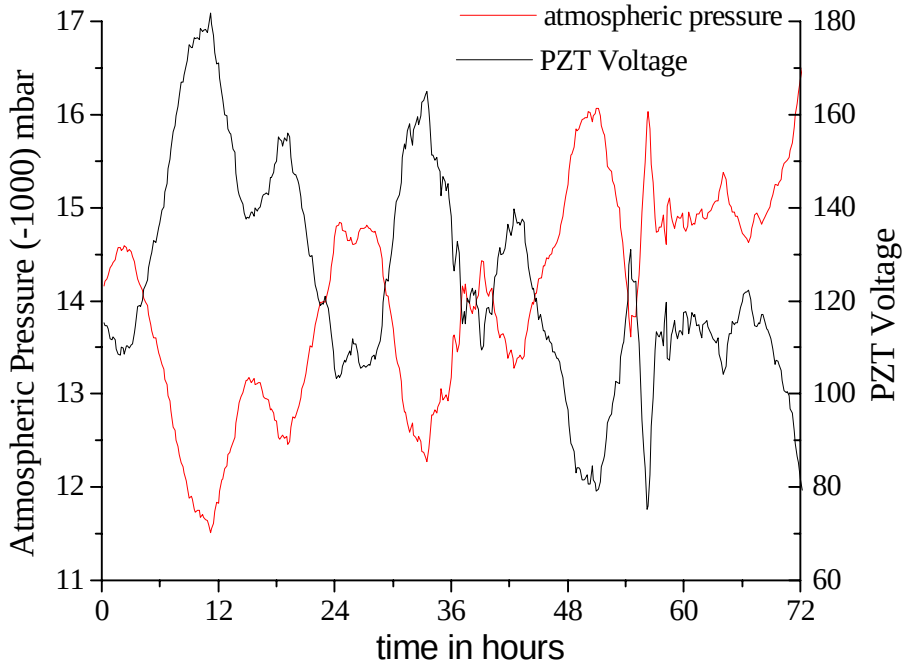
Pre-Stabilized Laser

- Master Oscillator Power Amplifier (MOPA) in almost continuous operation since 08/99
- Improvements made to Frequency Stabilization Servo
- Improvements made to Pre-Mode Cleaner
- Changes made to mirror mounts to reduce frequency noise
  - Ongoing table configuration improvements
- Intensity Stabilization (ISS) must still be installed
- Laser output power slowly degrading over time (about 3 W instead of 10 W)
  - Will need replacement if it fails (few days down time)

Pre-Mode Cleaner Changes

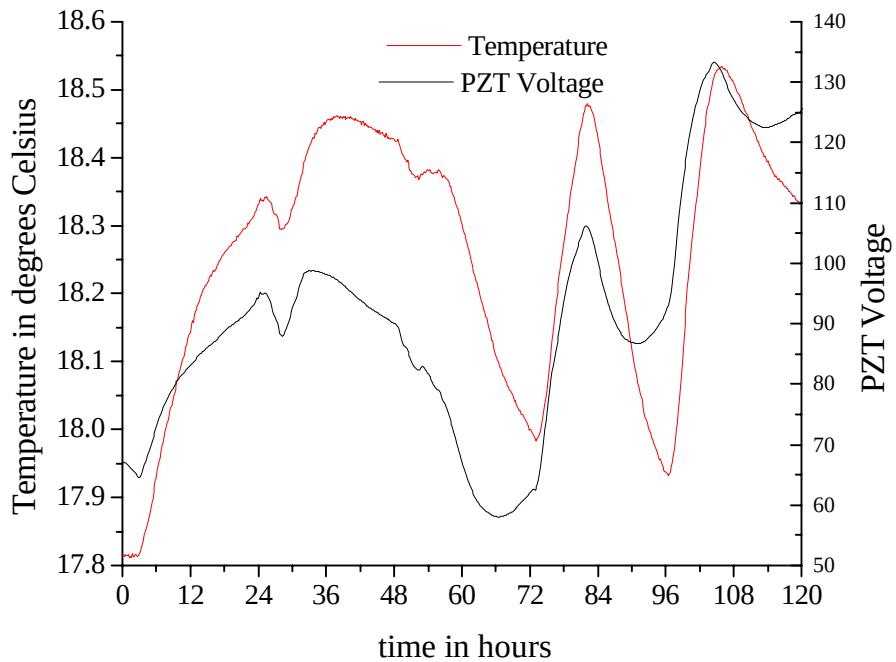
Old Pre-Mode Cleaner

- Epoxied at discrete points
- Open to atmosphere



New Pre-Mode Cleaner

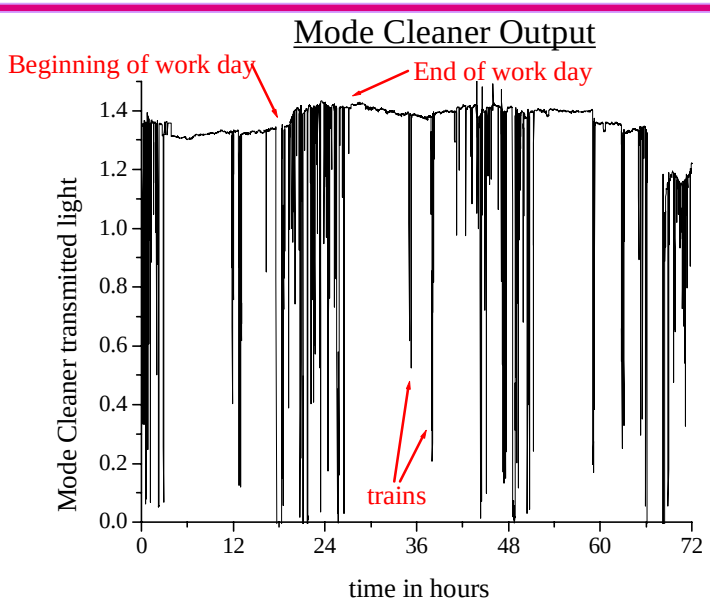
- Optically Cemented
  - Higher body resonance
- Hermetically sealed

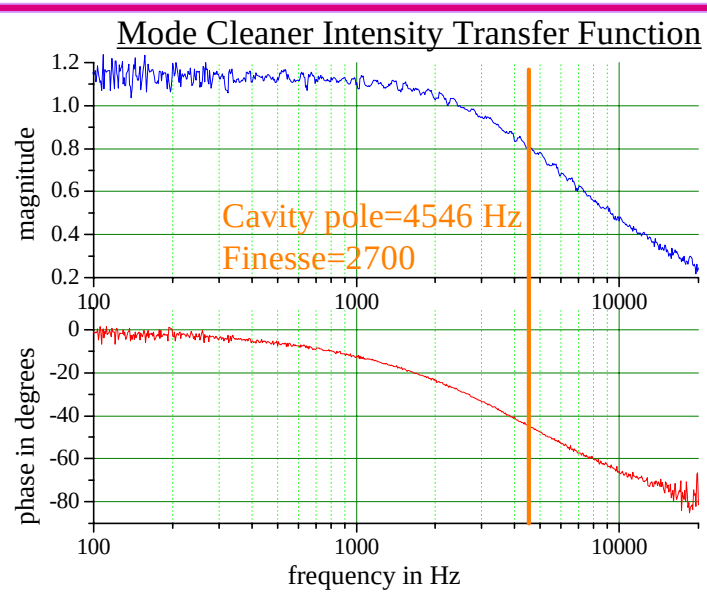


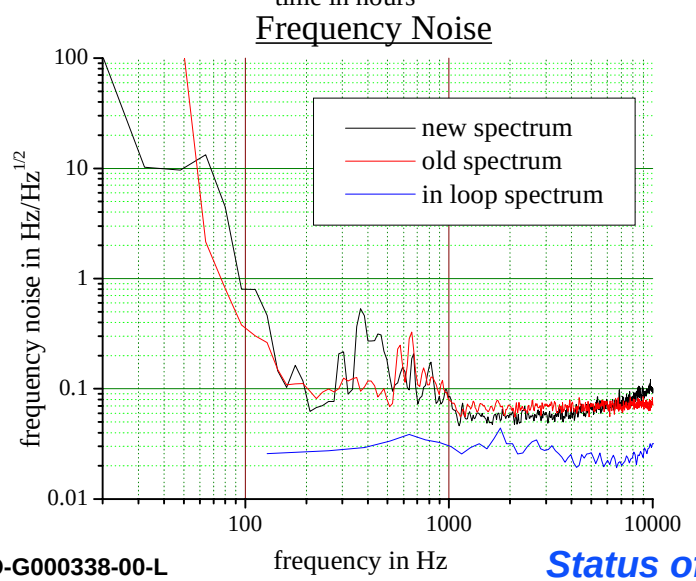
Mode Cleaner

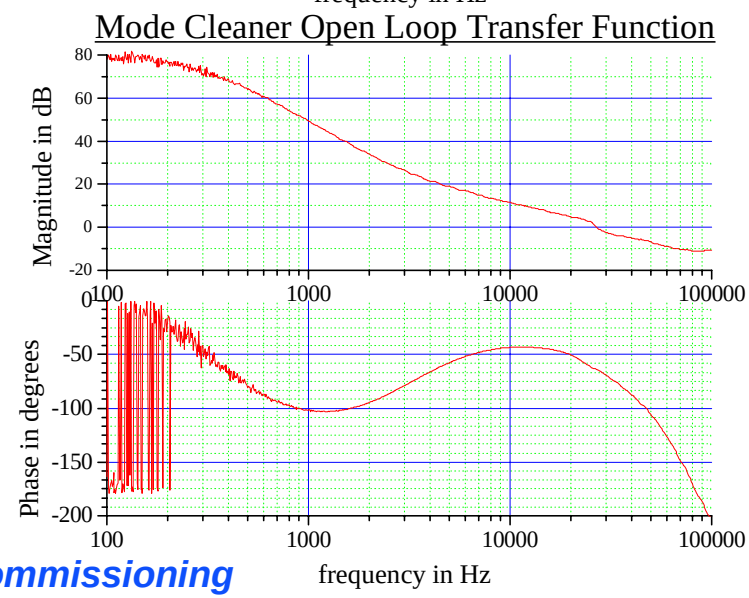
- Mode Cleaner operational with lock periods on the order of hours
  - More ground noise at LLO
  - Optic not hanging properly ?
  - Improving …
- Mode Cleaner Diagnostics
  - Servo transfer functions
  - Cavity Finesse
  - Mode Cleaner mirror internal Q's
  - Lock maintenance statistics
  - Pendulum, Pitch, Yaw suspension Q's
- Frequency Noise above specification
  - Acoustic sensitivity of optics on PSL table
- Operate at 100 mW of input power
  - Over 1 W of input power possible

Mode Cleaner Characteristics









Mode Cleaner Measured Parameters

- Mode Cleaner length measurement 12.239986 +/- 0.000001 m
  - 5.4 mm too short
  - Will be corrected
- Mirror internal mode Q's
  - 28.2 kHz drum mode
  - MC3 has a splitting of about 2 Hz

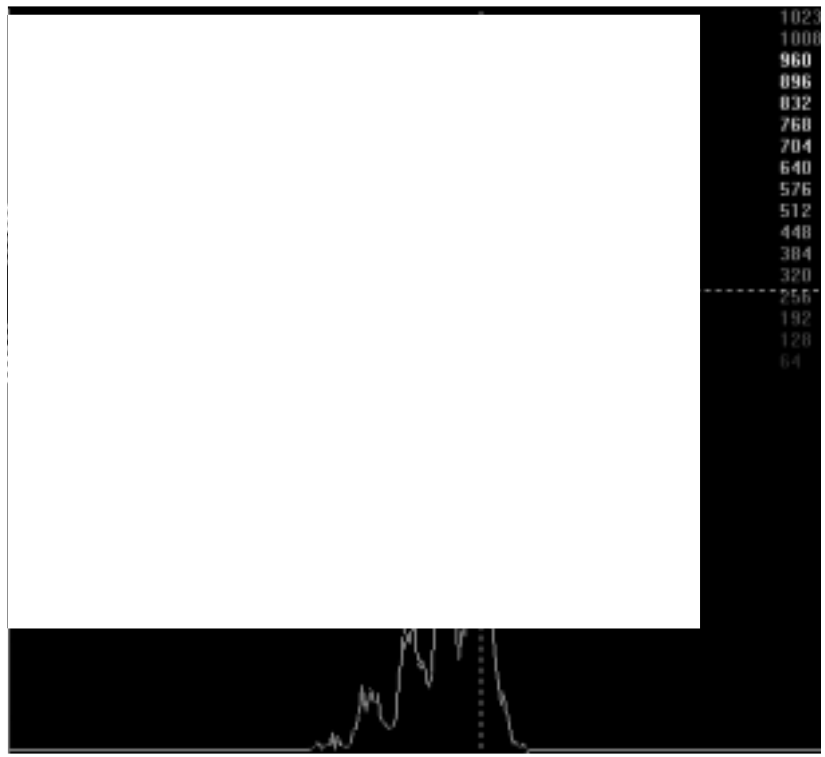
	Q
MC1	588 000 +/- 4000
MC2	607 000 +/- 3000
MC3	341 000 +/- 1000

- Position, Pitch, Yaw pendulum suspension Q's
  - MC2 shows non-exponential decay

	Position Q	Pitch Q	Yaw Q
MC1	23 000	4 600	10 000
MC2	3 900/300	560	600/300
MC3	10 000	3 300	9 900

Near Michelson Alignment

- Align Near Michelson Interferometer
  - Damp core optics
  - Set up optical levers
  - Develop alignment procedures
  - Set up cameras
  - Understand beams
  - Put optics under configuration control
- Prepare for injecting light into arms



Operations

- Compulsory daily morning commissioning meeting
  - Recap of previous day
  - Planning and coordination of days activity
- Use of the Control Room
  - Essential as interferometer becomes more and more complex
  - Staffing of control room
  - Daily checklist
- Use of Data Acquisition System and Tools
- Training of operators to run interferometer
  - Creation of operational diagrams and flow charts
  - Development of a LIGO Handbook and Operators Manual
- Institution of configuration control

Future

- Check each 4k arm alignment
- Lock recycled near-Michelson
- Do one arm tests
- Continue study of mode cleaner
- Engineering run
- Full Interferometer by April 2001