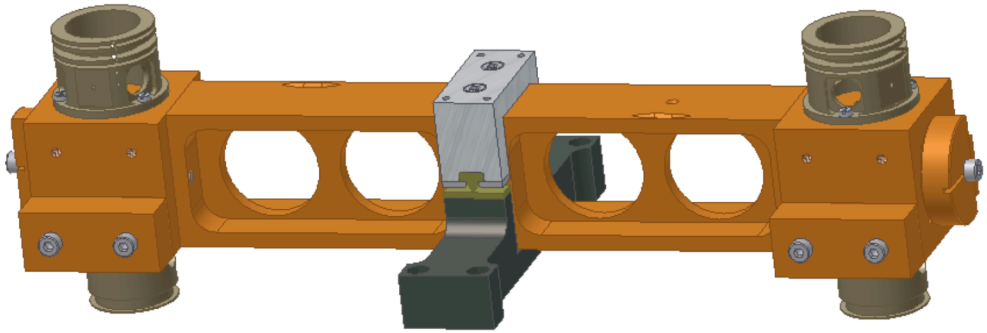
LIGO

Interferometric Readout for Tiltmeter



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@ LIGO - Caltech

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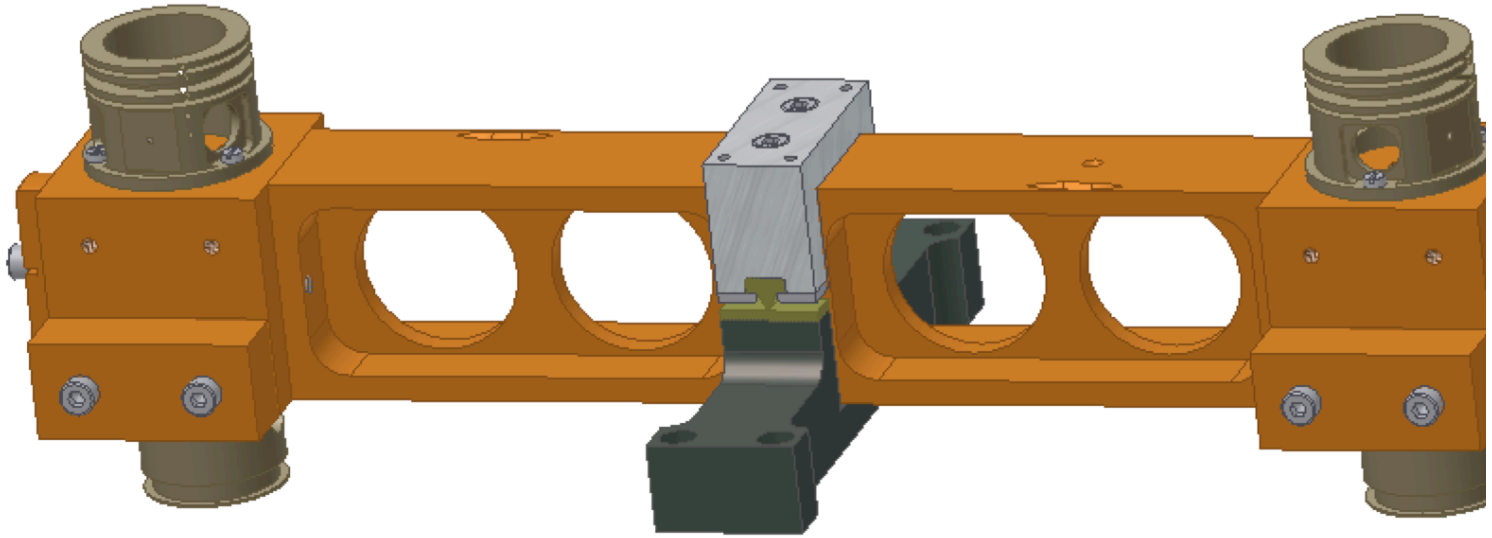
LIGO-G1001037

The Michelson interferometer

- The tiltmeter is already successfully working with a readout sensitivity of

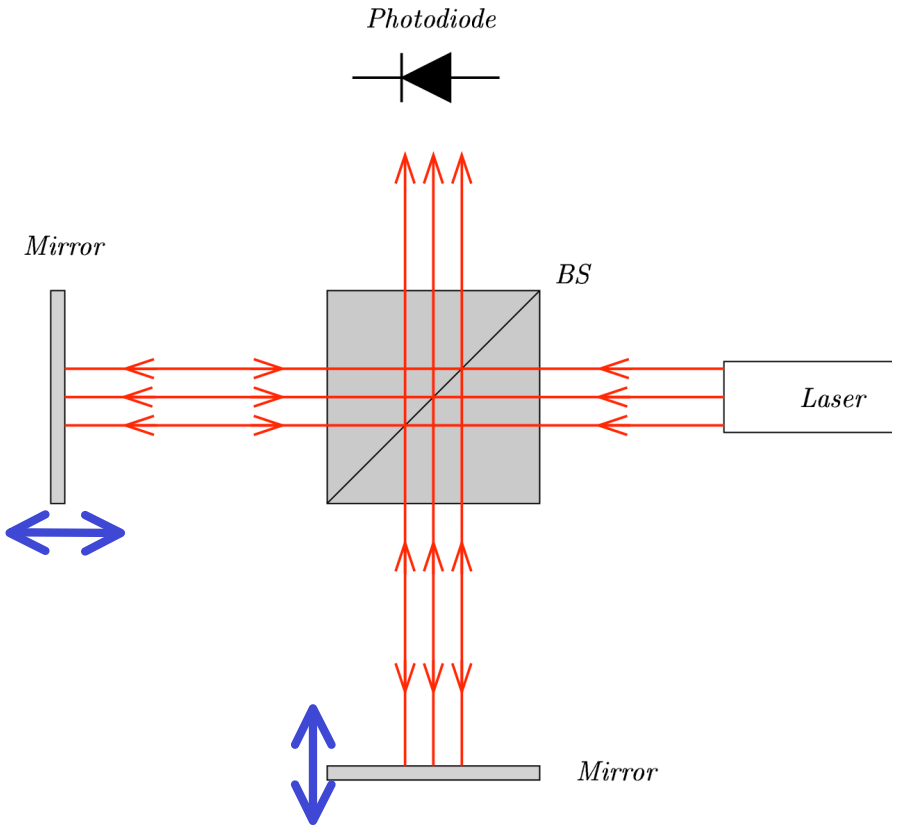
$$9 \times 10^{-11} rad / \sqrt{Hz}$$

using the LVDT's.



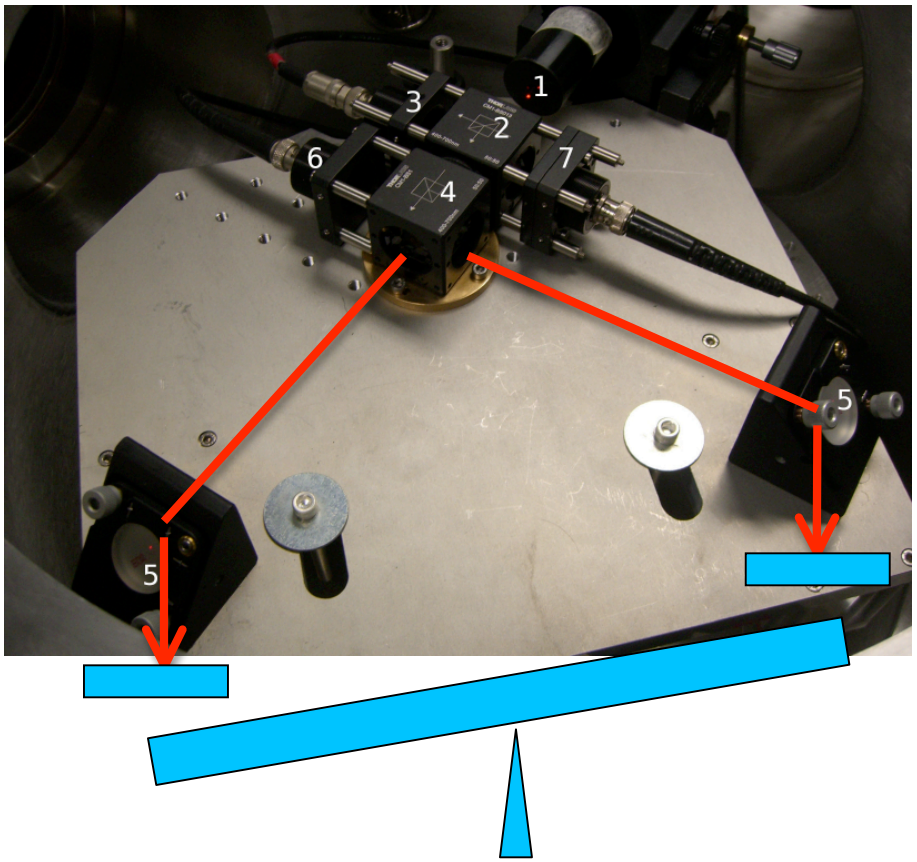
The Michelson interferometer

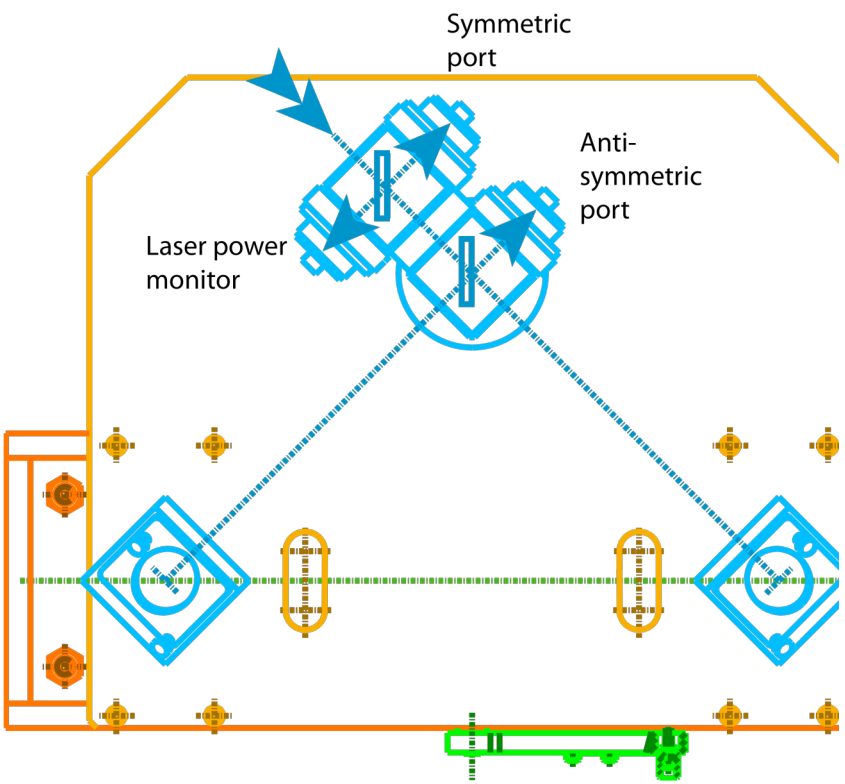
- The interferometric readout
- A tool for testing
  - Advanced wedges
  - The elastic properties of flexures and new materials
- To improve the ultimate performance of tiltmeters



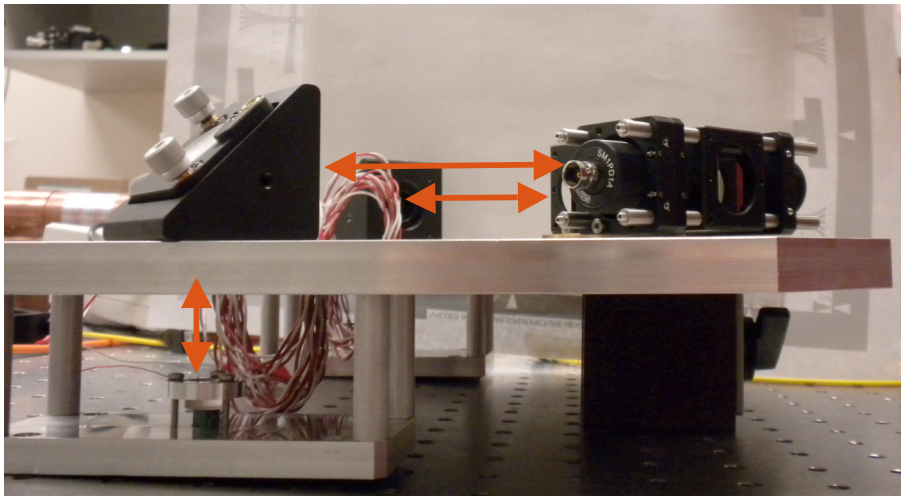
The interferometer and the tiltmeter (1)

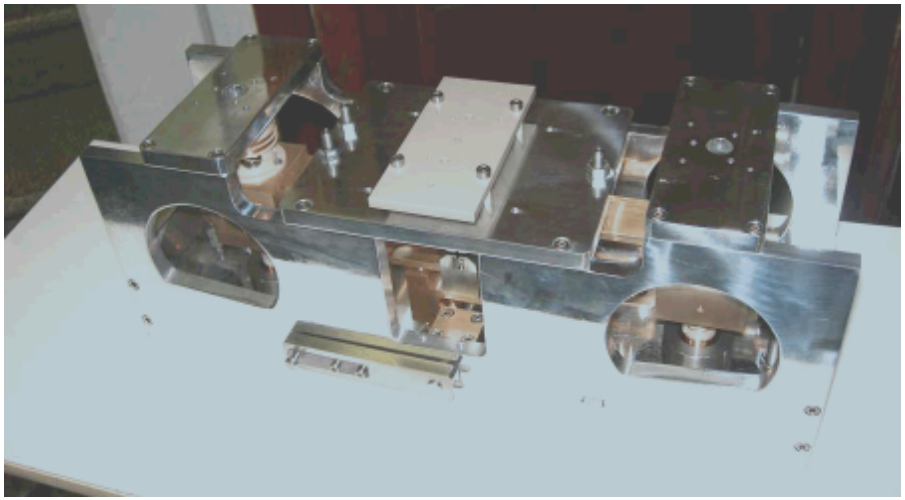
Interferometer implementation scheme

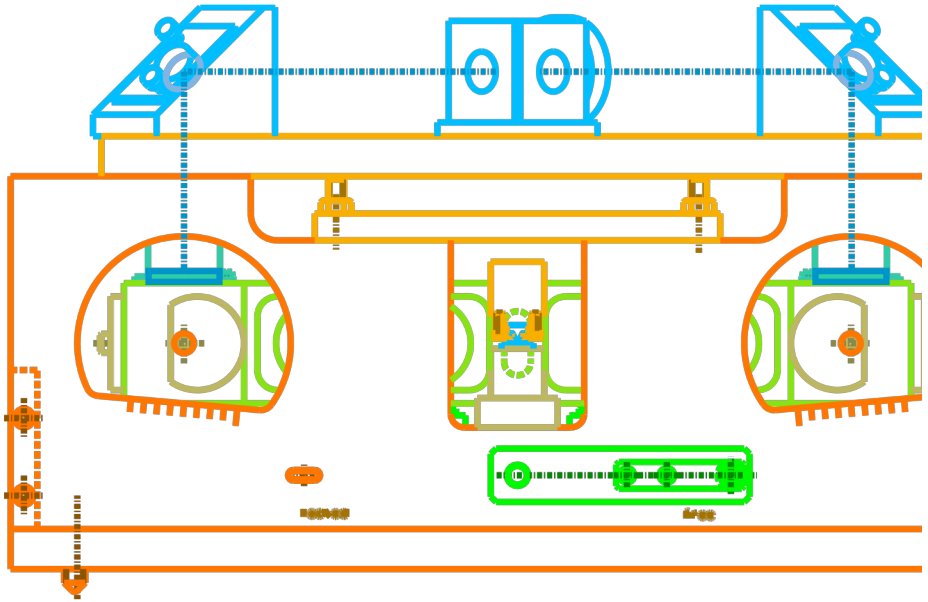




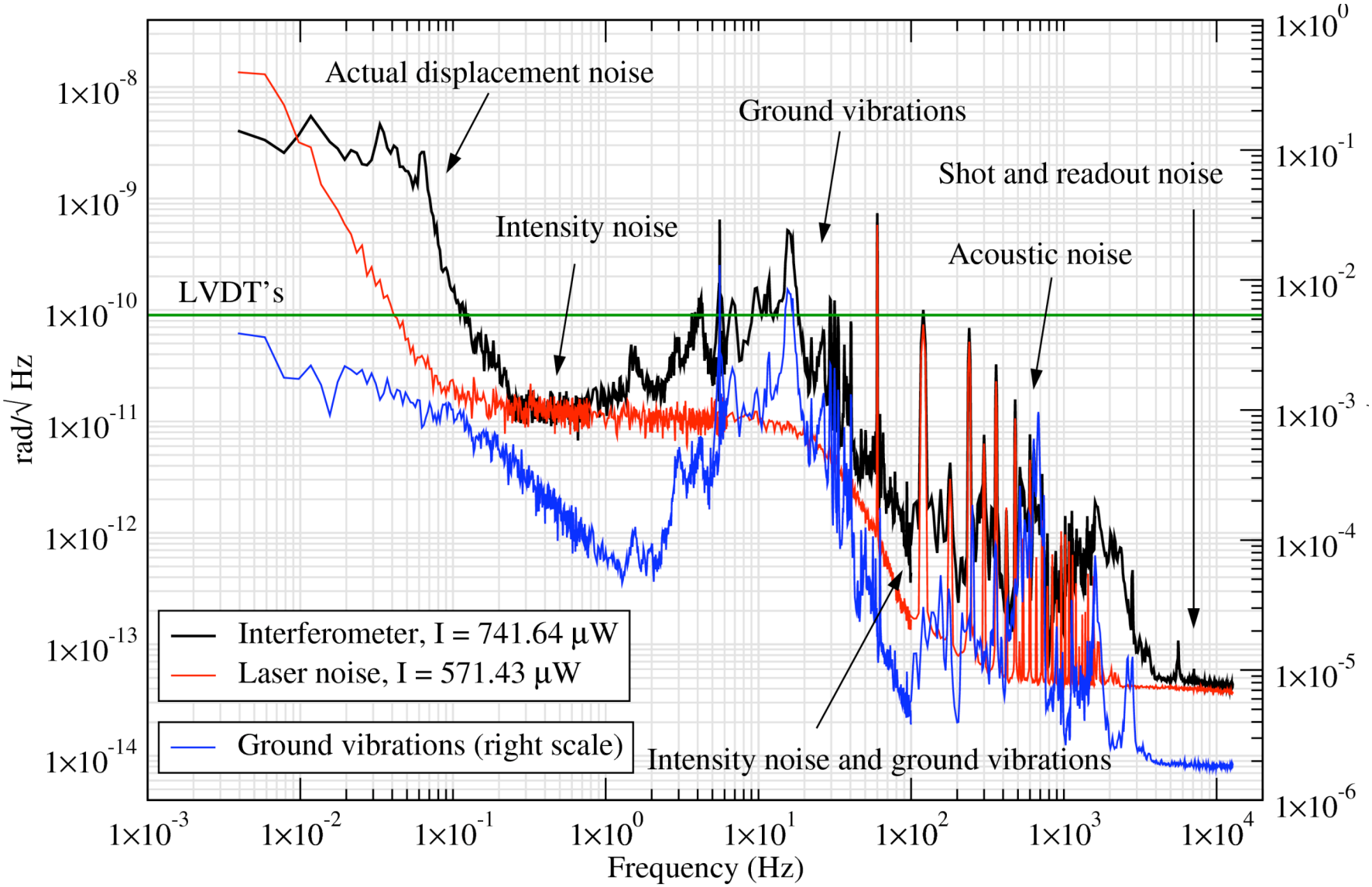
The interferometer and the tiltmeter (2)



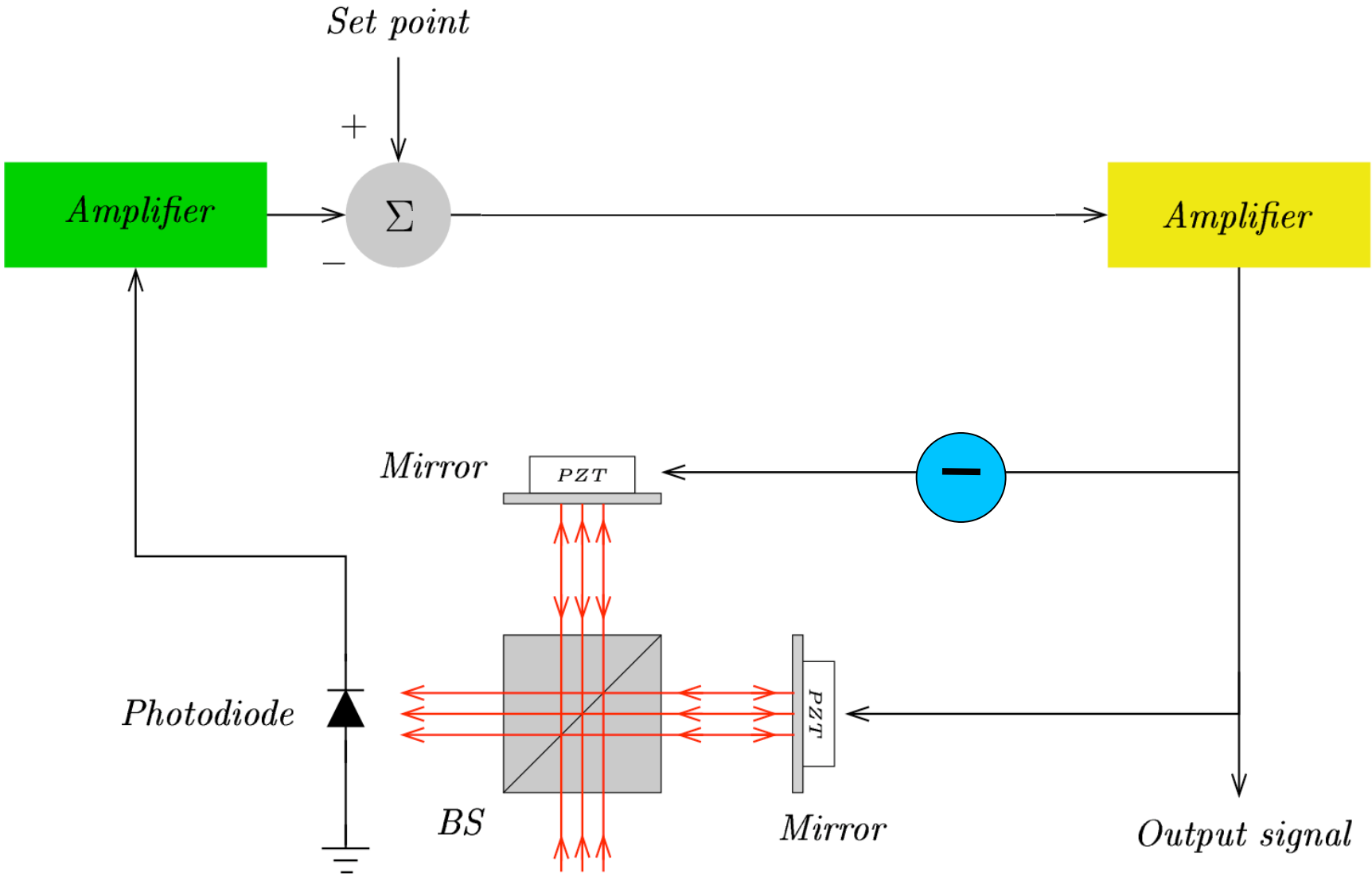




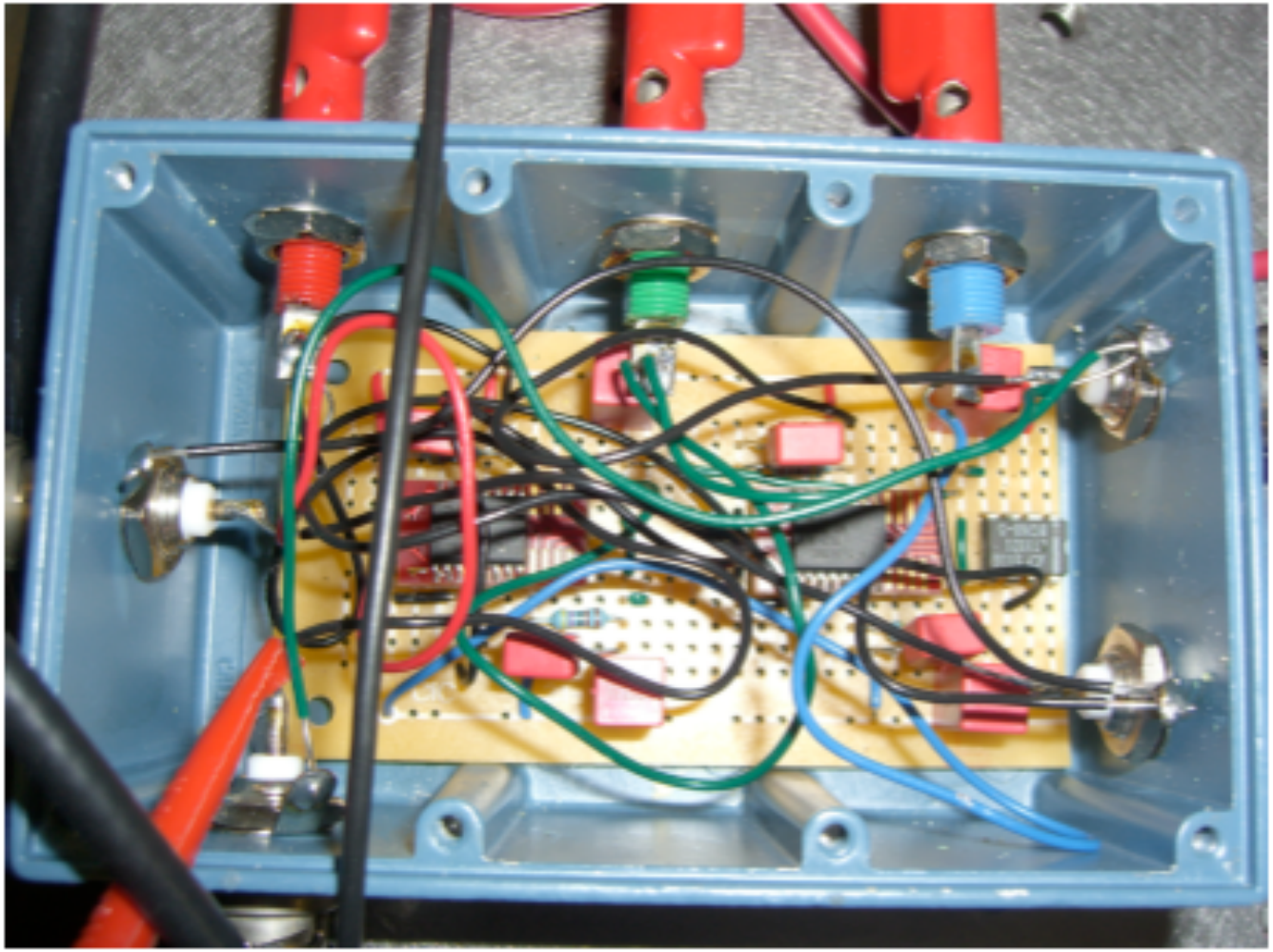
Sensitivity of the unlocked interferometer



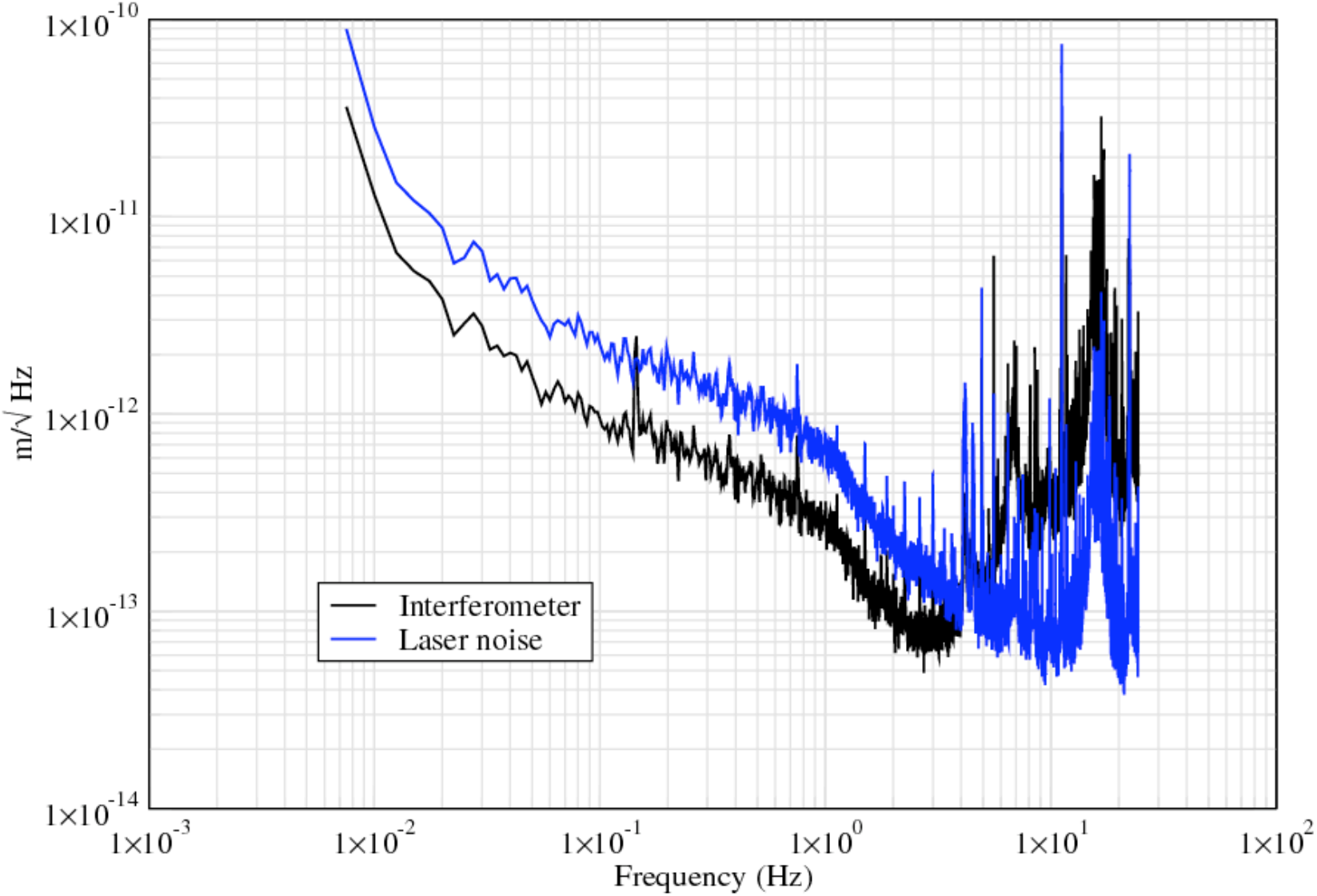
Feedback loop for locking the interferometer



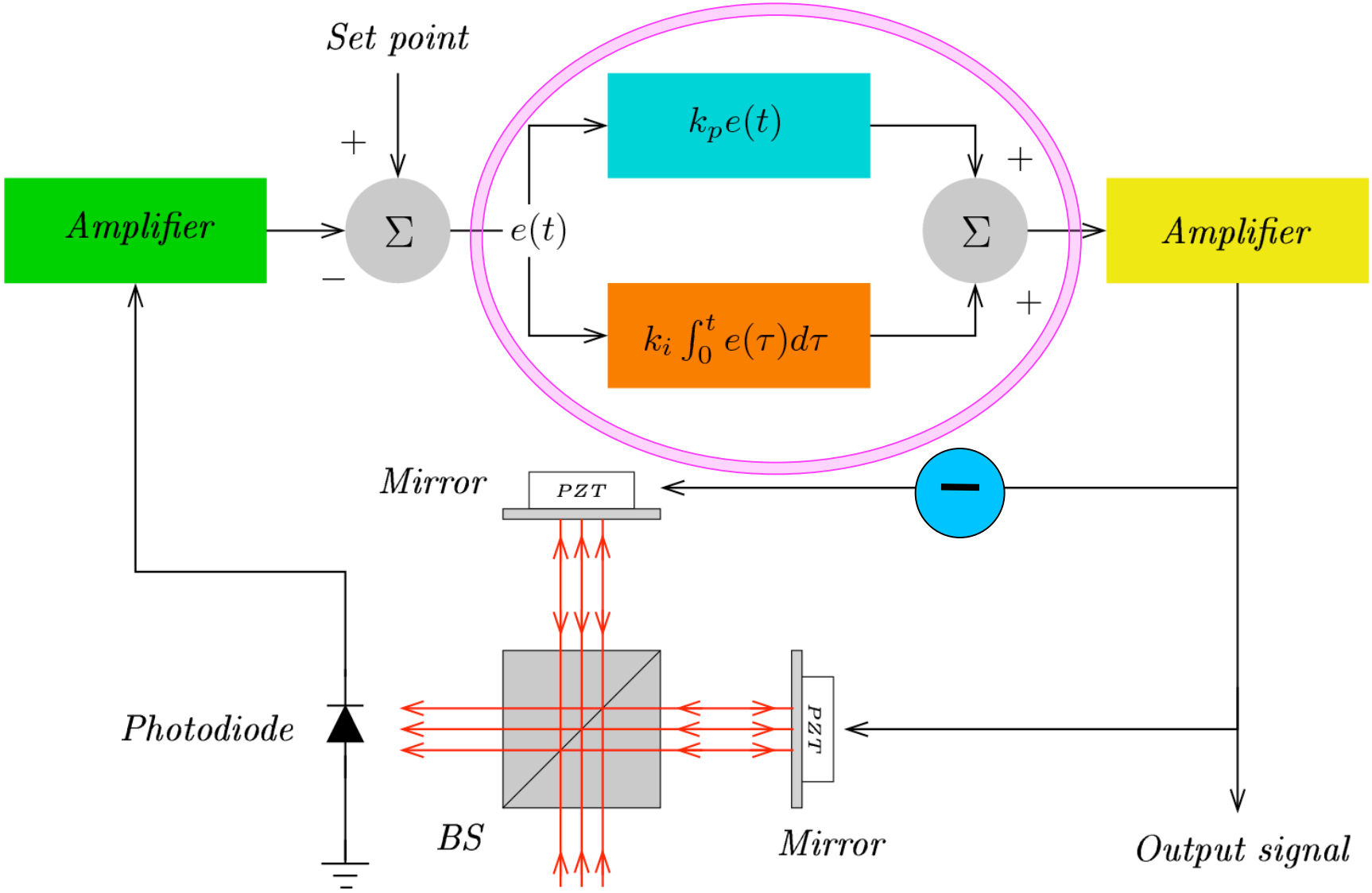
Feedback circuit



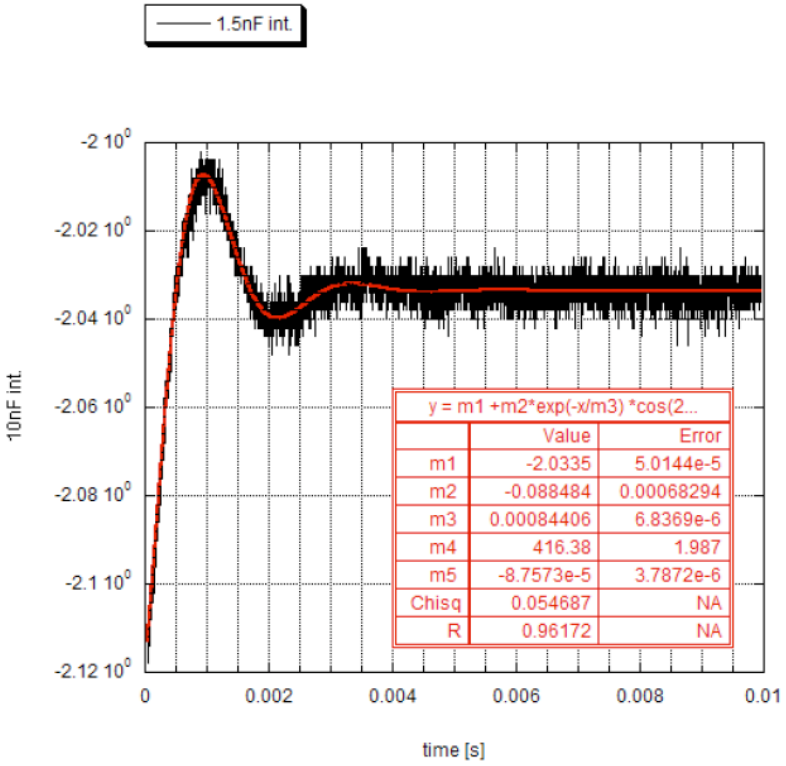
Sensitivity of the locked interferometer



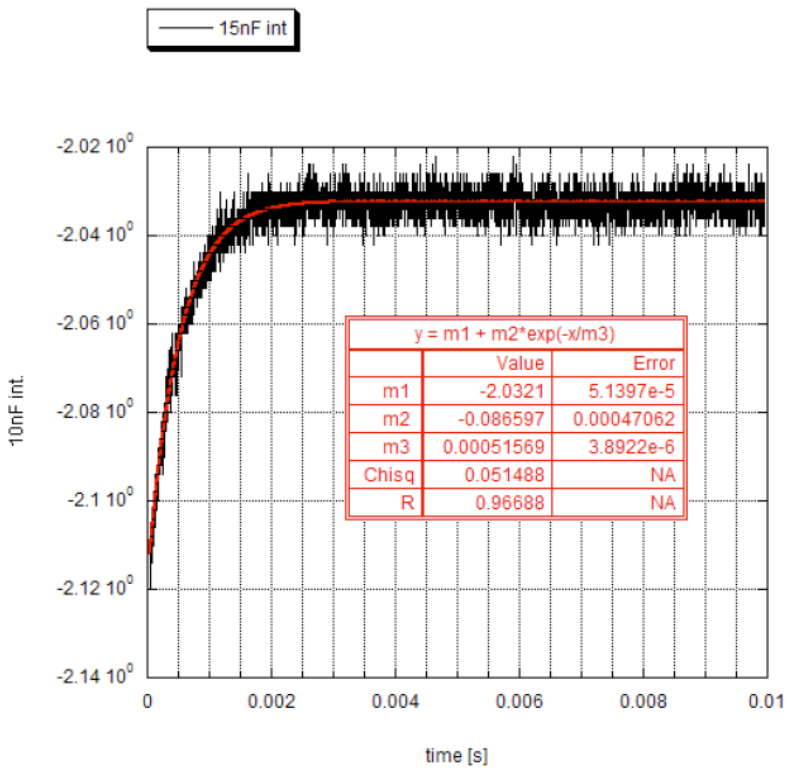
Details of the Feedback loop, response speed



Effects of feedback Filter



Without filter



With the filter

- With the filter we can bring the voltage steadily to the desired voltage by adjusting the speed.

Future work

- **Reduce the effect of laser intensity noise.** Normalize the value of the intensity of the interference pattern with the value of the incoming laser power.
- **Use an optic fibre to deliver the laser.** The laser cavity is a source of heat that should be kept away.
- **Remove feedback light.** A Faraday isolator will be implemented between the laser and the fiber to keep any light from going back into the laser cavity.
- **Place the interferometer in vacuum.** This will reduce acoustic noise and any possible disturbance of air currents.
- **Implement the interferometer on the tiltmeter.**