LISA optical bench testbed

Thermal environment and laser infrastructure

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Abstract

The optical bench (OB) is a part of the LISA spacecraft, situated between the telescope and the testmass. From the OB the laser beams are sent to the testmass and to the remote spacecraft through the telescope. For measuring the distances there are several interferometers on the OB. The elegant breadboard of the OB for LISA is developed for the European Space Agency (ESA) by EADS Astrium, TNO Science & Industry, University of Glasgow and the Albert Einstein Intitute (AEI), the performance tests then will be done at the AEI. Here we present the testbed that will be used for the performance tests with the focus on the thermal environment and the laser infrastructure.

EEB of optical bench for LISA

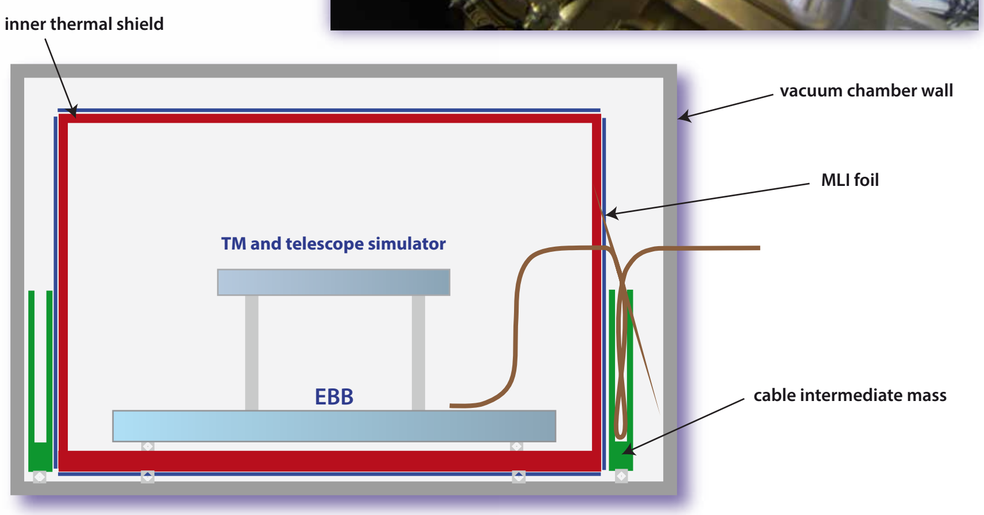
The elegant breadboard (EBB) of the LISA OB is developed and will be build at the Universtiy of Glasgow. It holds several interferometers:

- science interferometer for measuring the distance to the remote spacecraft
- testmass interferometer for reading out the distance to testmass
- reference interferometer
- PAAM interferometer for point ahead angle mechanism

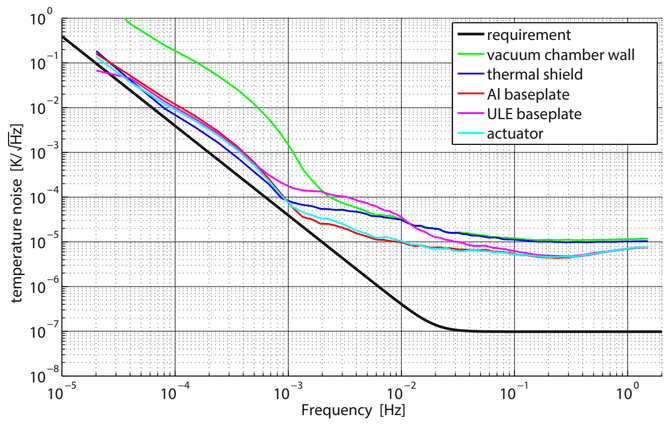
For testing: a testmass and a telescope simulator are needed. This will be realized on a second zerodur bench placed on top of the EBB

test facility

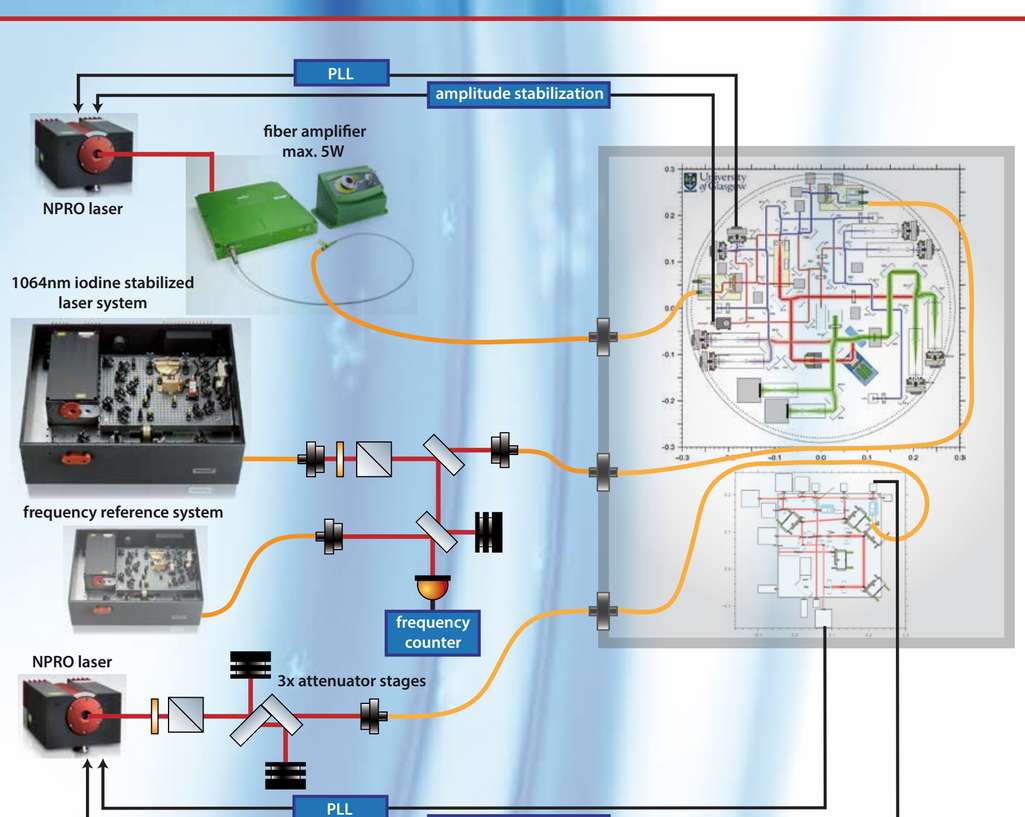
The vacuum chamber for the EBB performance tests. It is placed on air damped feet and shielded for a good temperature stability.



With an additional outer thermal shield (made of bubble wrap) to attenuate the lab temperature fluctuations, the required temperature stability is nearly achieved.



Laser infrastructure

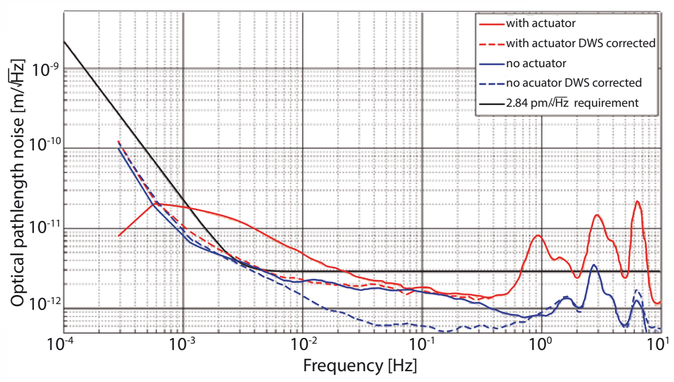


- a high power beam and a local oscillator beam for the EBB
- a pikowatt beam for the telescope simulator

piezo actuators

The piezo actuators - used as a testmass simulator and needed for aligning the telescope simulator - have a big thermal expansion coefficient and induce therefor pathlenght noise. So they have to be mounted on specially designed thermally compensated mounts.

- for simulation of testmass motions: tip-tilt plus linear actuator
- for alingment: tip-tilt actuators only



length measurement with one actuator and thermally compensated mount

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