GRACE-C LASER RANGING INSTRUMENT - LRI

GRACE-C Laser Ranging Instrument (LRI)

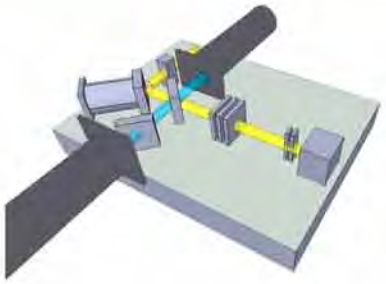
To ensure the continuation of the gravity field measurements, a Grace-Continuity (Grace-C, also referred to as Grace follow-on) mission is currently under discussion in an US – German cooperation. To allow a cost efficient development and a launch in 2016, the GRACE-C satellites are planned to be very similar to the original GRACE satellites. In addition to the K-Band it is planned to fly an experimental laser ranging instrument (LRI), based on a laser interferometer. The goal of the LRI is to improve the distance measurement accuracy significantly to some nanometers at 0.1 Hz frequency.
Challenging key instrument requirements:

- Ranging measurement accuracy of 50nm/√Hz (for 10-100mHz)
- Laser beam co-alignment of less than 50 µrad

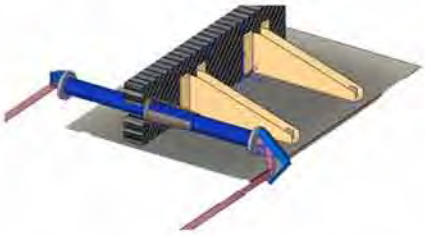
The instrument consists of a frequency stabilized laser, a triple mirror assembly (retroreflector), an optical bench and an electronics board to evaluate the interference signal.

Main tasks at STI are:

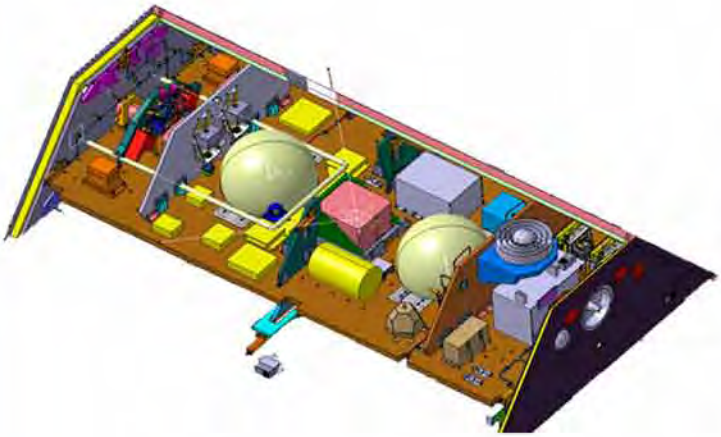
- Development of the triple mirror assembly, a light weight retroreflector providing the beam routing with 600 mm beam offset and 25 µrad co-alignment accuracy
- Development of the optical bench including beam steering mechanism and electronics
- In house assembly, integration and Test of the EMs and PFMs on unit- and instrument-level and support at spacecraft-level



Optical bench including tip tilt mirror assembly

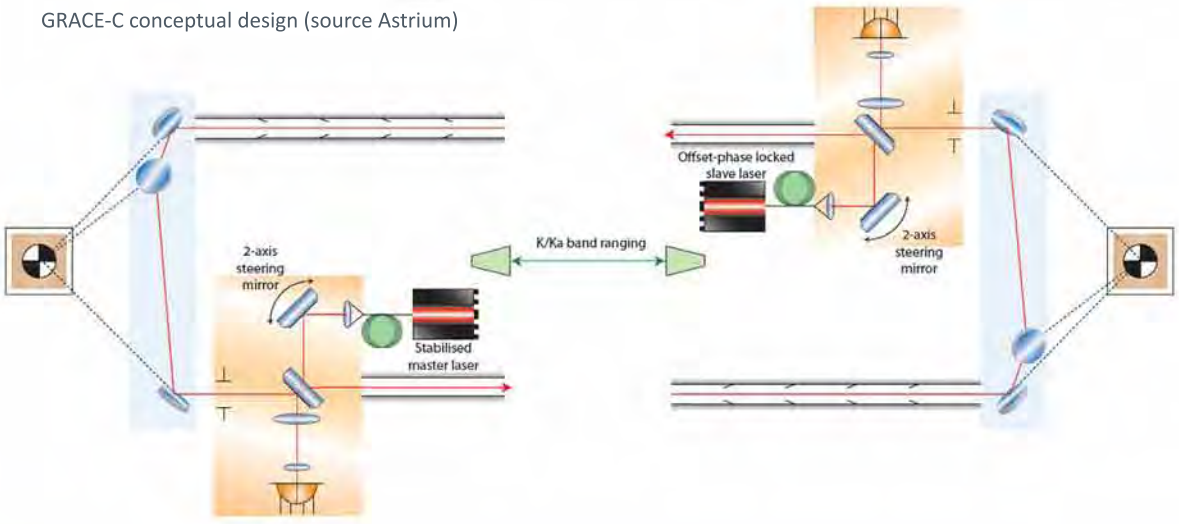


Triple mirror retro-reflector



GRACE-C conceptual design (source Astrium)

Mission	
Intended Satellite Launch	2016
Payload	K-band ranging system and Laser ranging instrument (LRI).
Orbit Altitude	~ 425 km
Orbit Inclination	~ 90°
Orbit period	92.9 minutes
S/C – S/C along track distance	220 km
S/C – S/C across track distance	Up to 27 km
S/C pointing accuracy	300 µrad
Max rel. S/C-S/C velocity	approx. 5m/s



Laser interferometer based inter satellite ranging instrument setup (source AEI)