



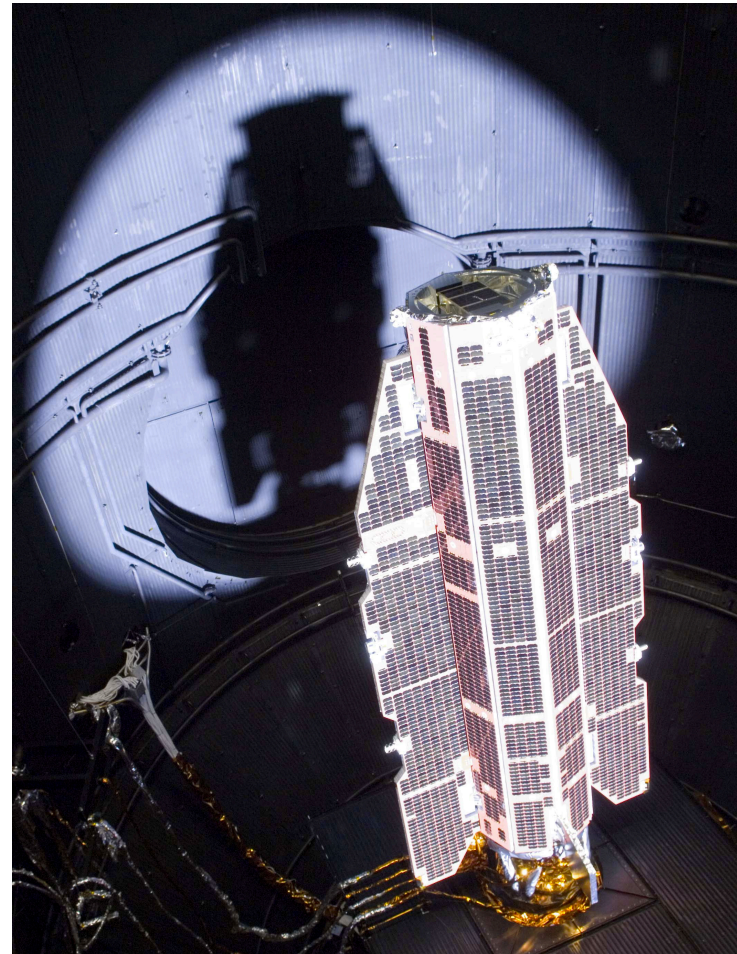
Status and Performance of the GOCE Satellite

M.Fehringer, D.Muzi, R.Floberghagen, J.Pineiro, Ch.Steiger

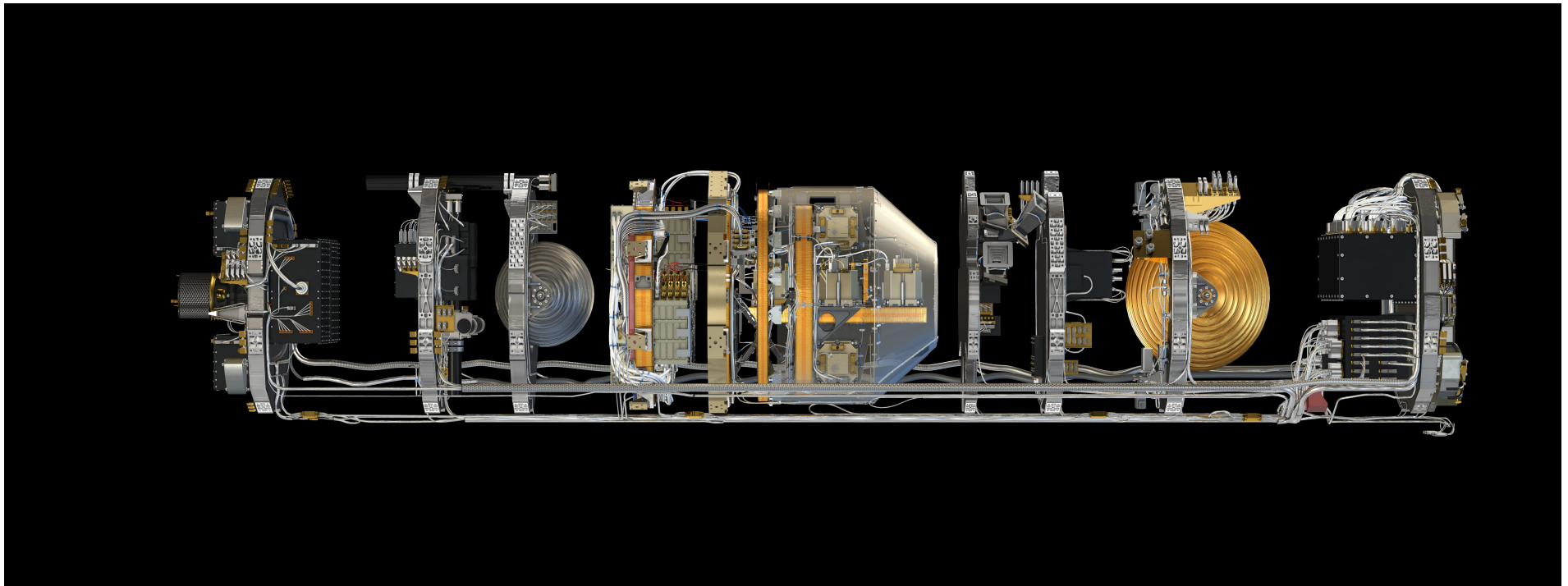
Satellite Characteristics



- 3 axis stabilised, nadir pointing, aerodynamically shaped satellite
- 5.3 m long, 1.1 m² cross section, Launch mass 1050 kg
- drag free attitude control (DFACS) in flight direction employing a proportional Xe electric propulsion system
- Very rigid structure, no moving parts
- Attitude control by magnetorquers
- N₂ cold gas thrusters for gradiometer calibration
- Body and wing mounted solar panels
- GaAs triple junction solar cells, 1300 W



Satellite Characteristics

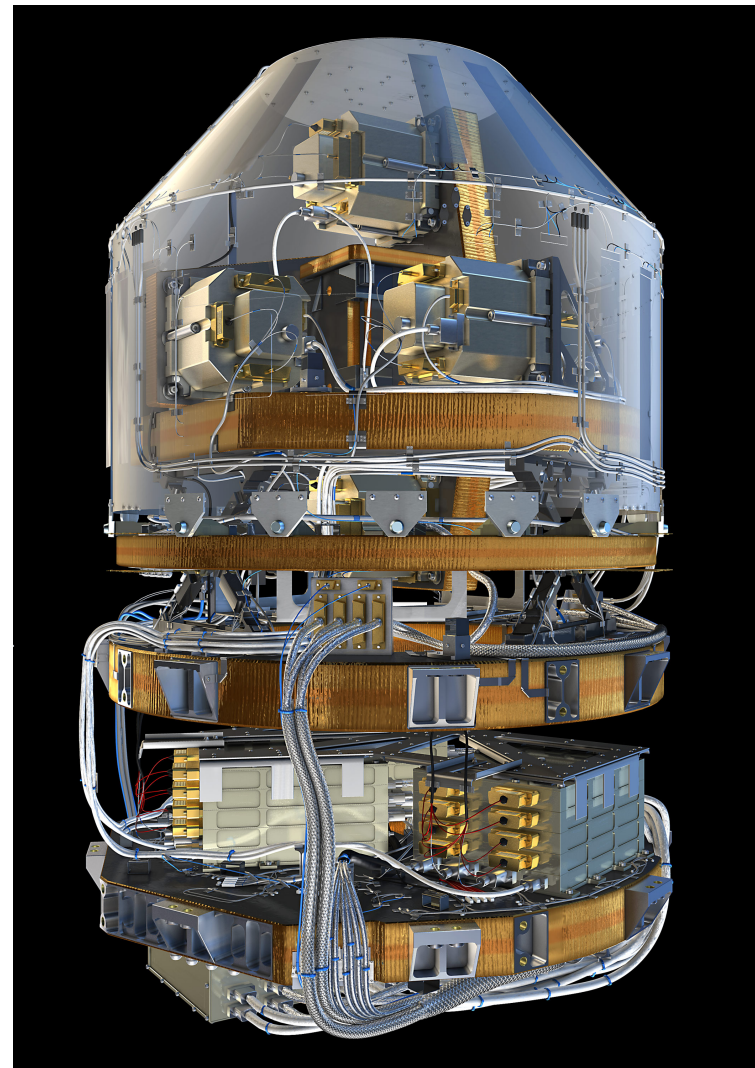


Payload - Gradiometer



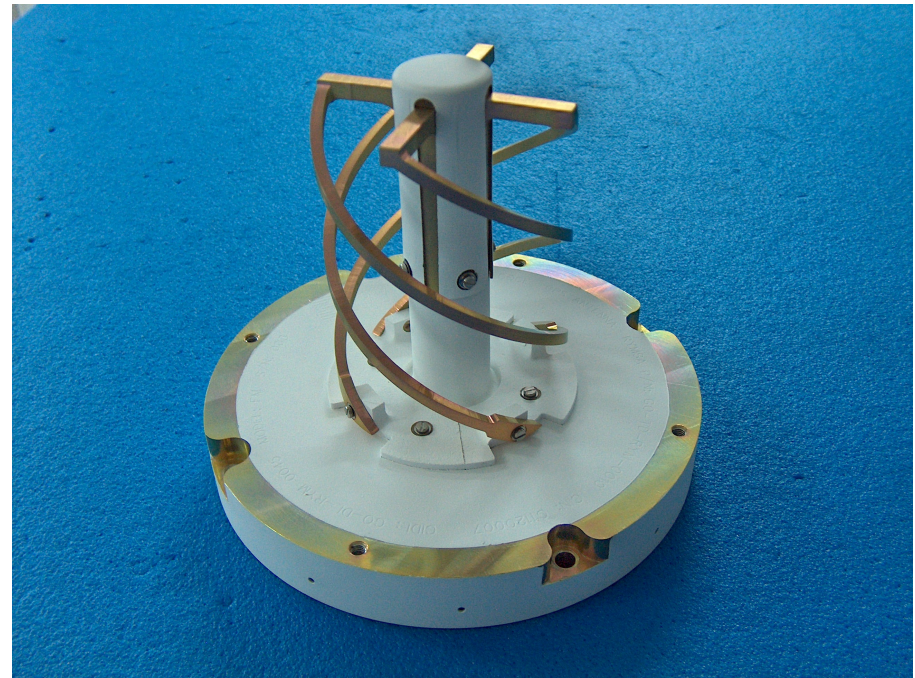
Electrostatic Gravity Gradiometer

- 3 pairs of servo-controlled capacitive accelerometers on ultra stable carbon-carbon compound structure
- 0.5 m arm length
- Accelerometer sensitivity: 2×10^{-12} m/sec² rHz
- Structural stability: 0.2 ppm/K
- Temperature stability: 10 mK over 200 sec (actively controlled)
- Overall stability: few pm in bandwidth
- Mass 180 kg
- Power 100 W
- Gradiometer bandwidth: 5 to 100 mHz
- Used also as AOCS sensor

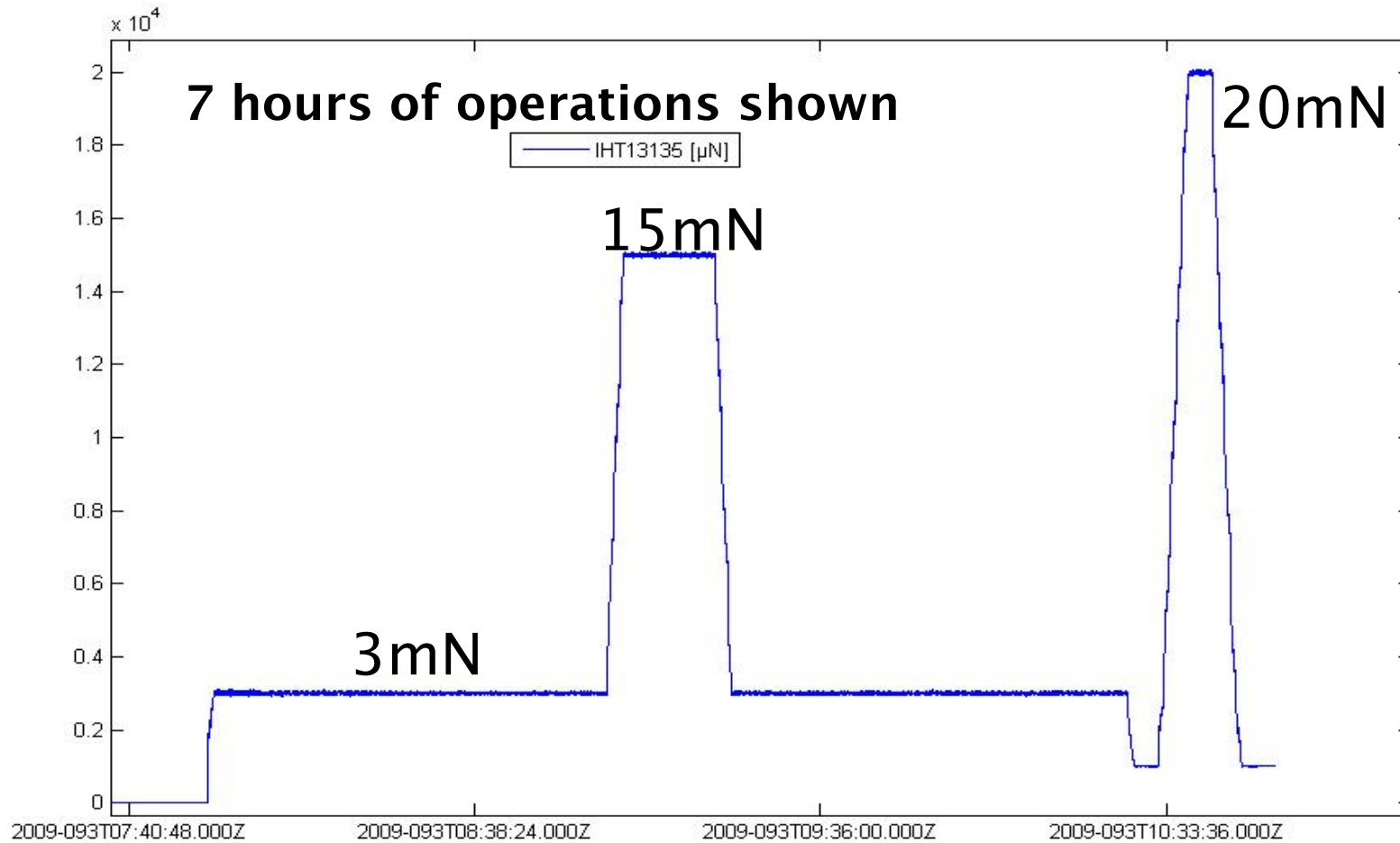


Satellite to Satellite Tracking Instrument

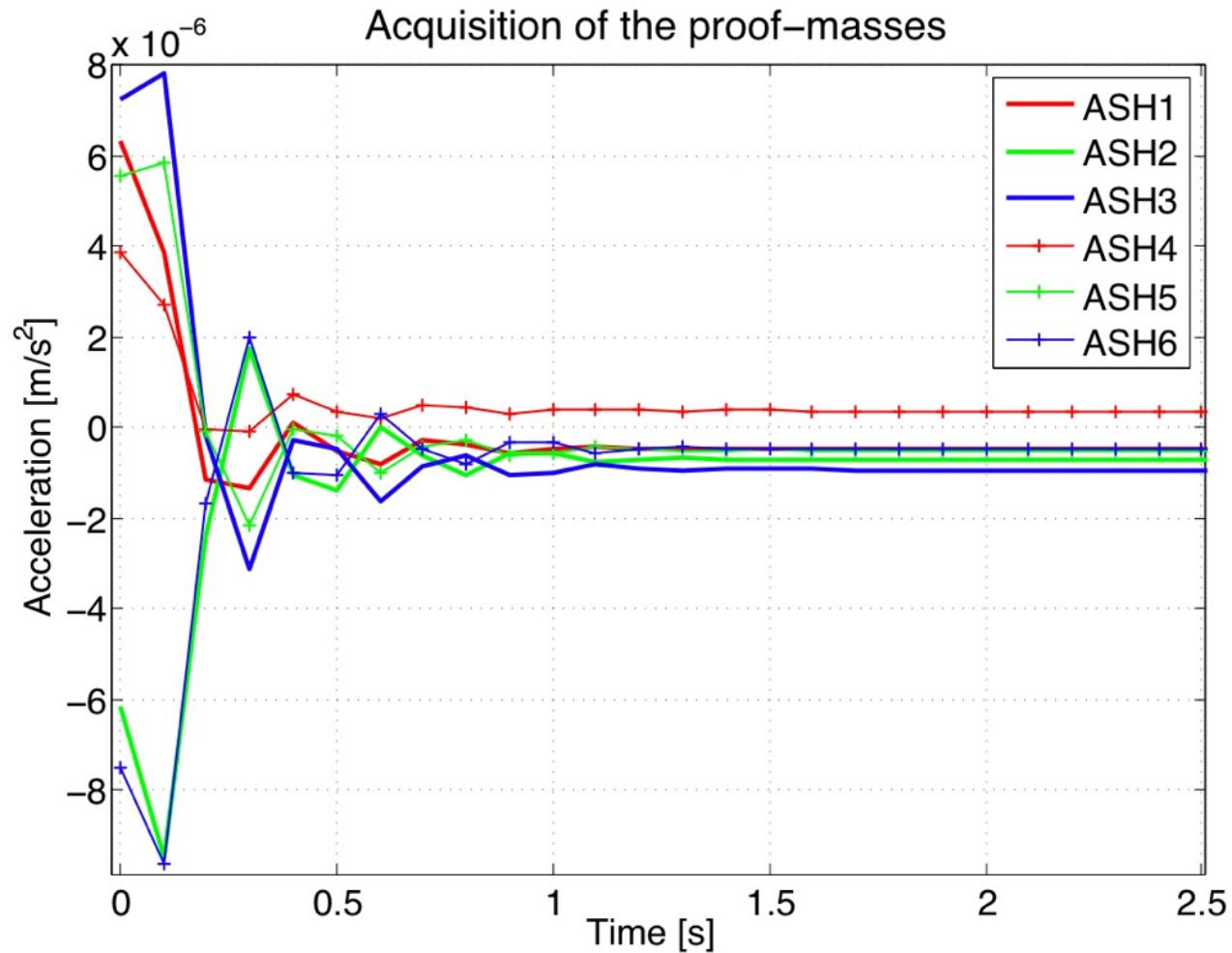
- Dual frequency L1, L2
- 12 channel GPS receiver
- Real time position and velocity (3D, 3 sigma) < 100 m, < 0.3 m/s
- 1 Hz data rate
- Science and real time on board solution for navigation



Commissioning - Ion Propulsion



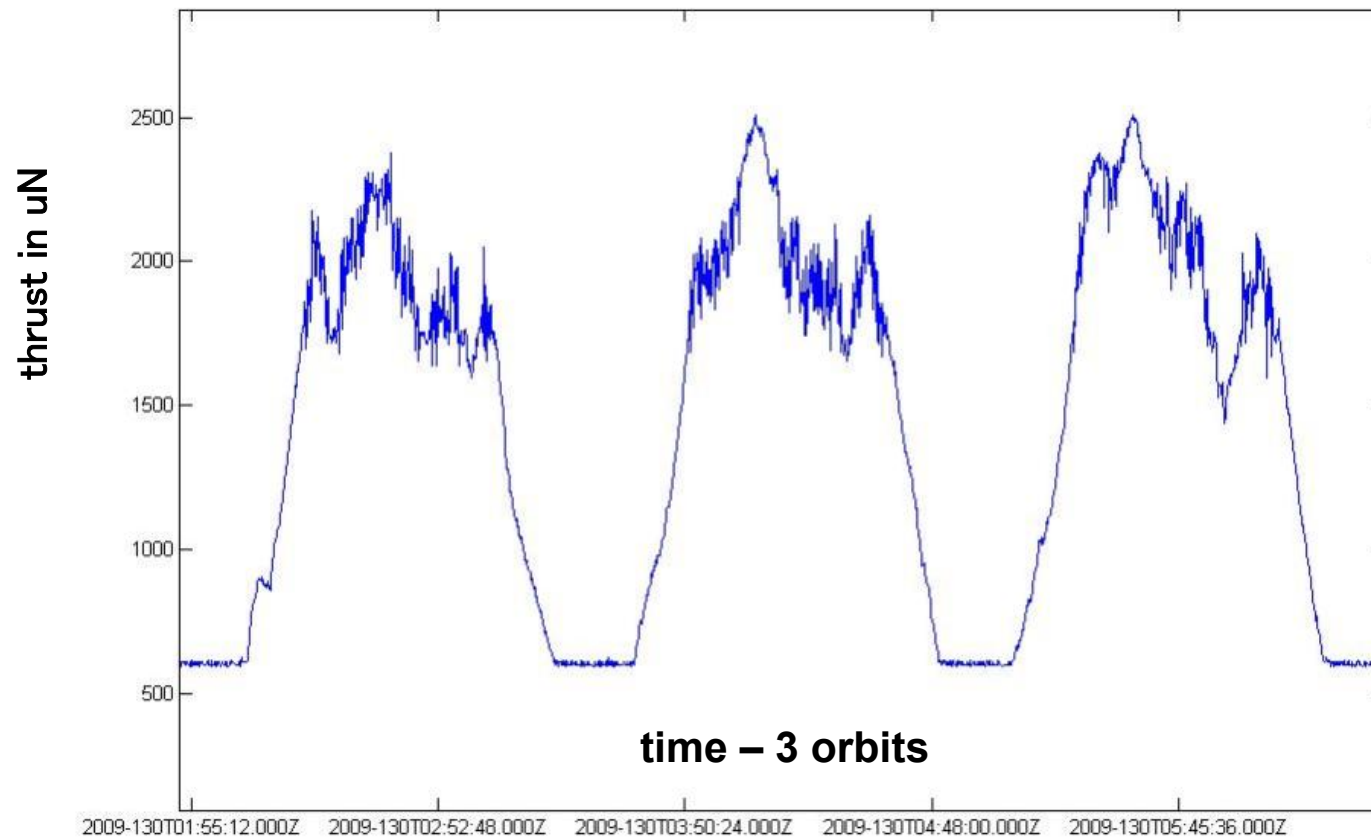
Commissioning - Gradiometer



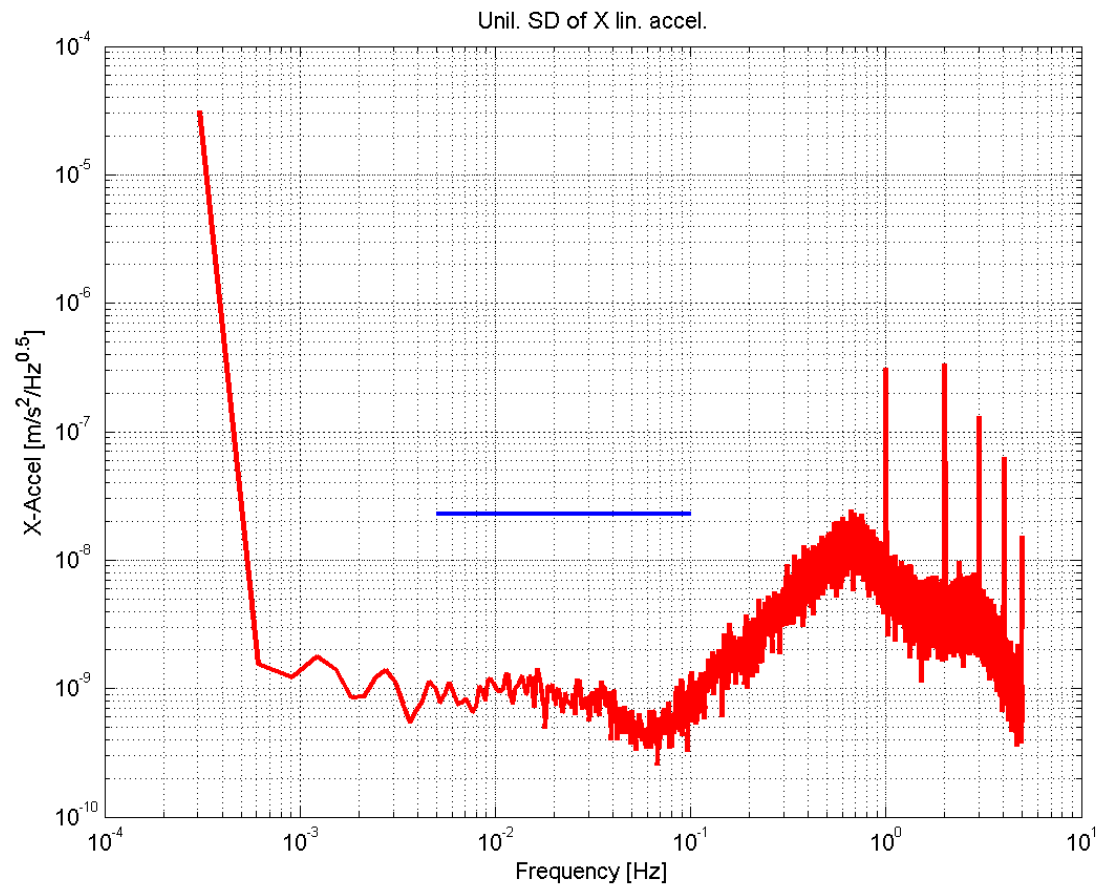
Commissioning - DFACS



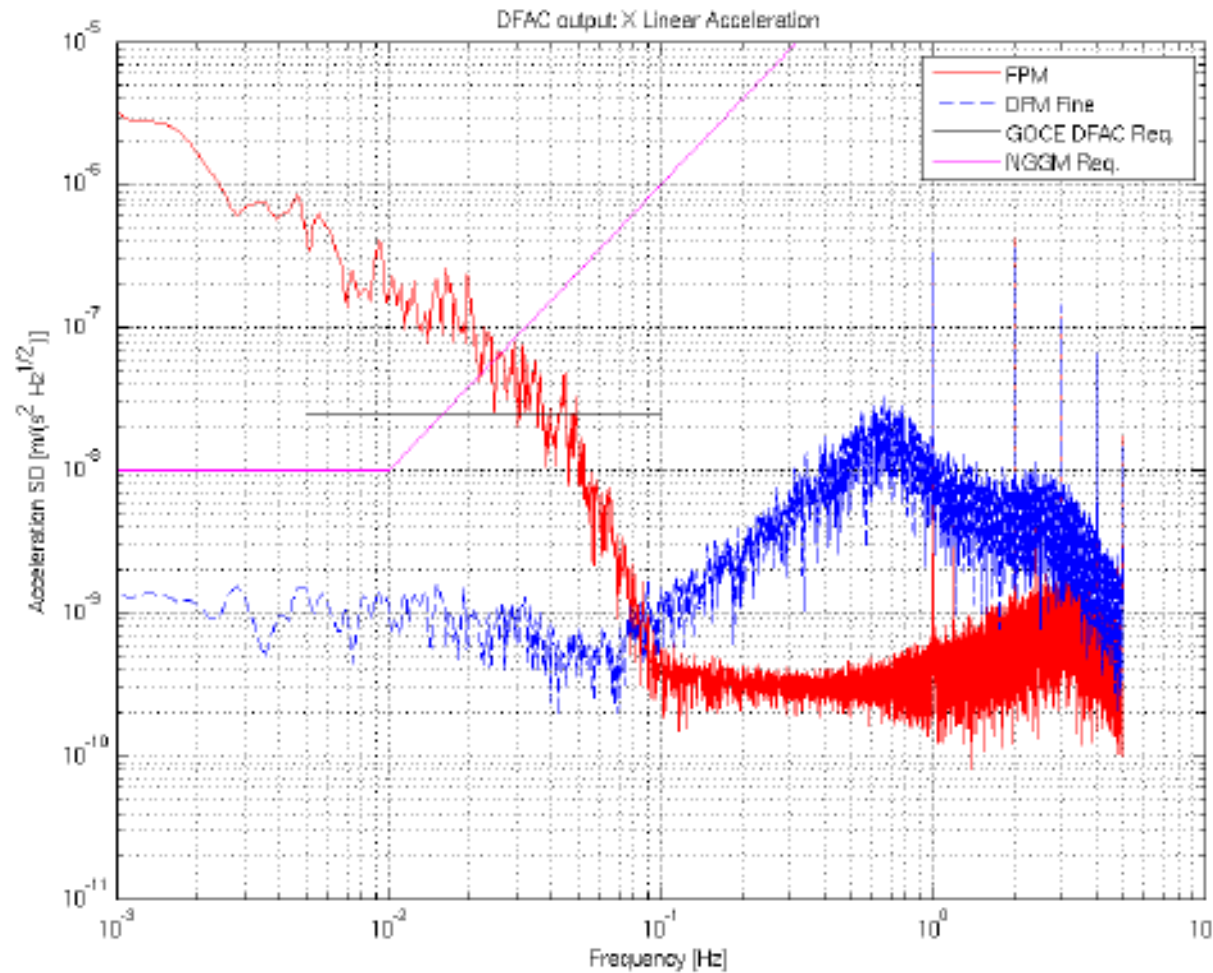
First time in Drag Free Mode - May 2009



PSD of common mode acceleration in flight direction

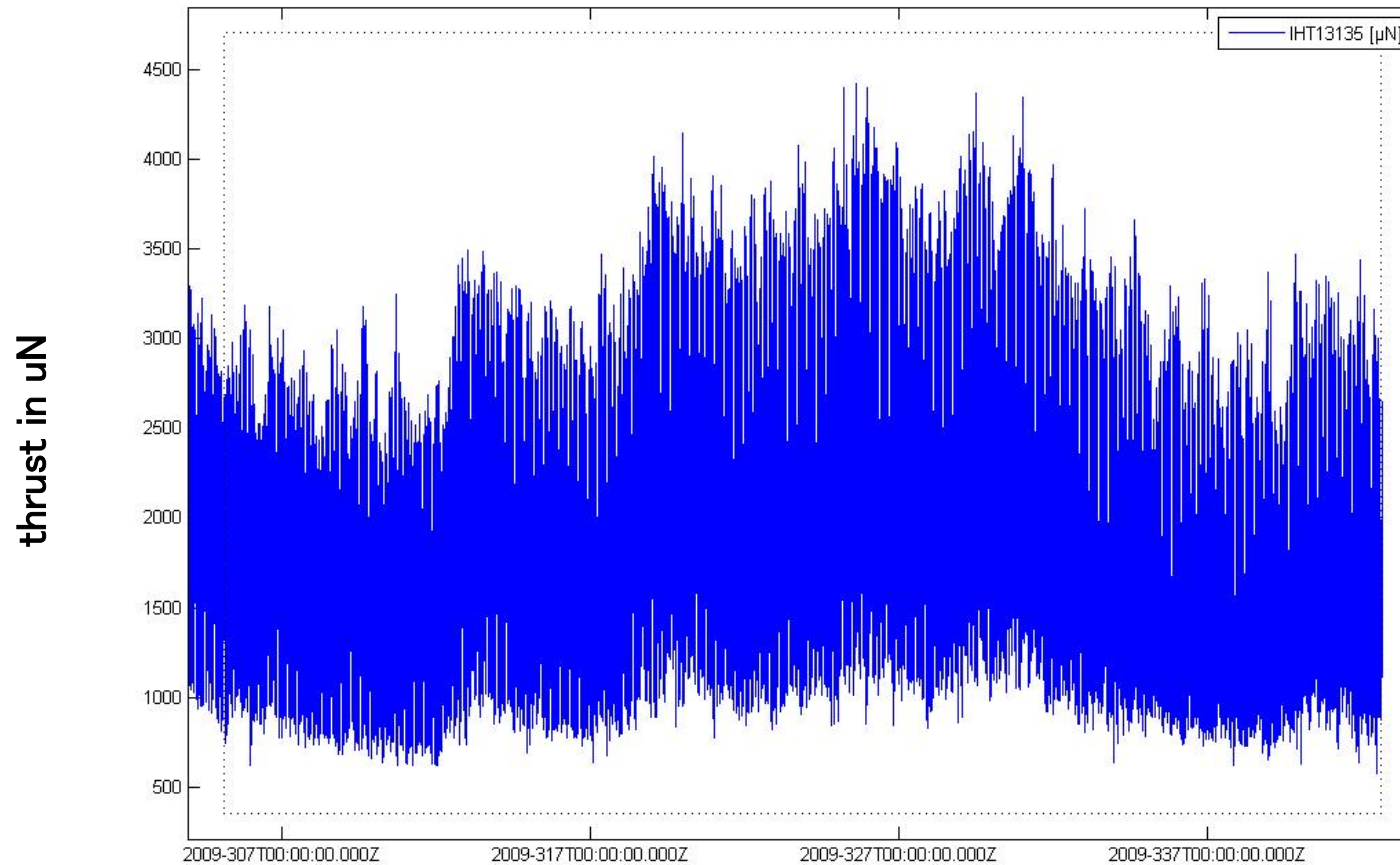


Performance DFACS



linear acc. in flight direction w/wo drag free control

Performance DFACS



Delivered thrust 1 Nov to 9 Dec 09

Mission status and performance

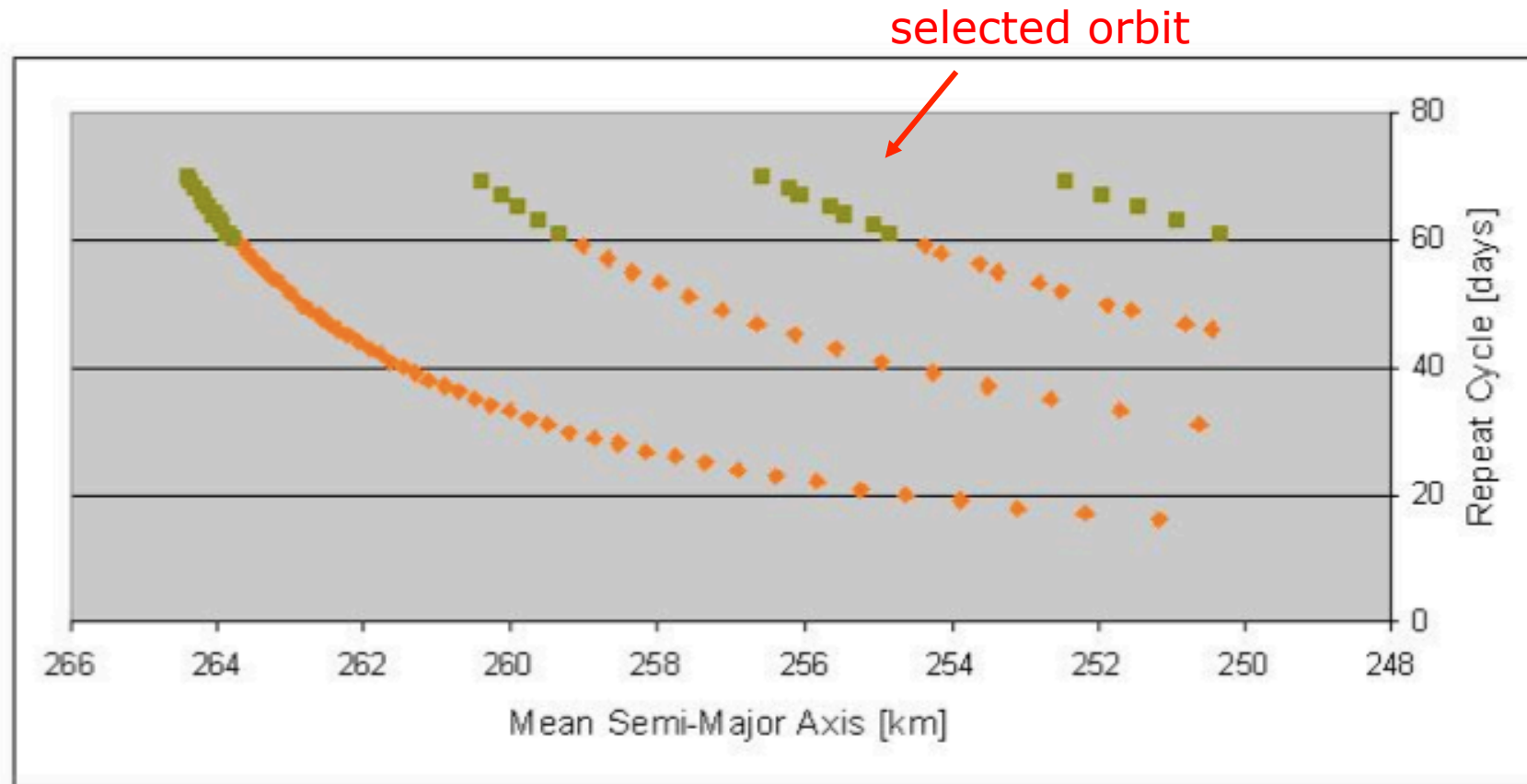


- We need 100 km spatial sampling of the geoid and gravity field
- $< 0.4^\circ$ (about 40 km) ground repeat pattern with longitudinal spacing between adjacent tracks at equator
- 254.9 km orbit with 61 day/979 orbits repeat has been selected
- Altitude control $< +/-50$ m due to neighbouring short repeat cycles
- First 61 days cycle will be completed on 26 December 2009

Mission status and performance



Mission status and performance

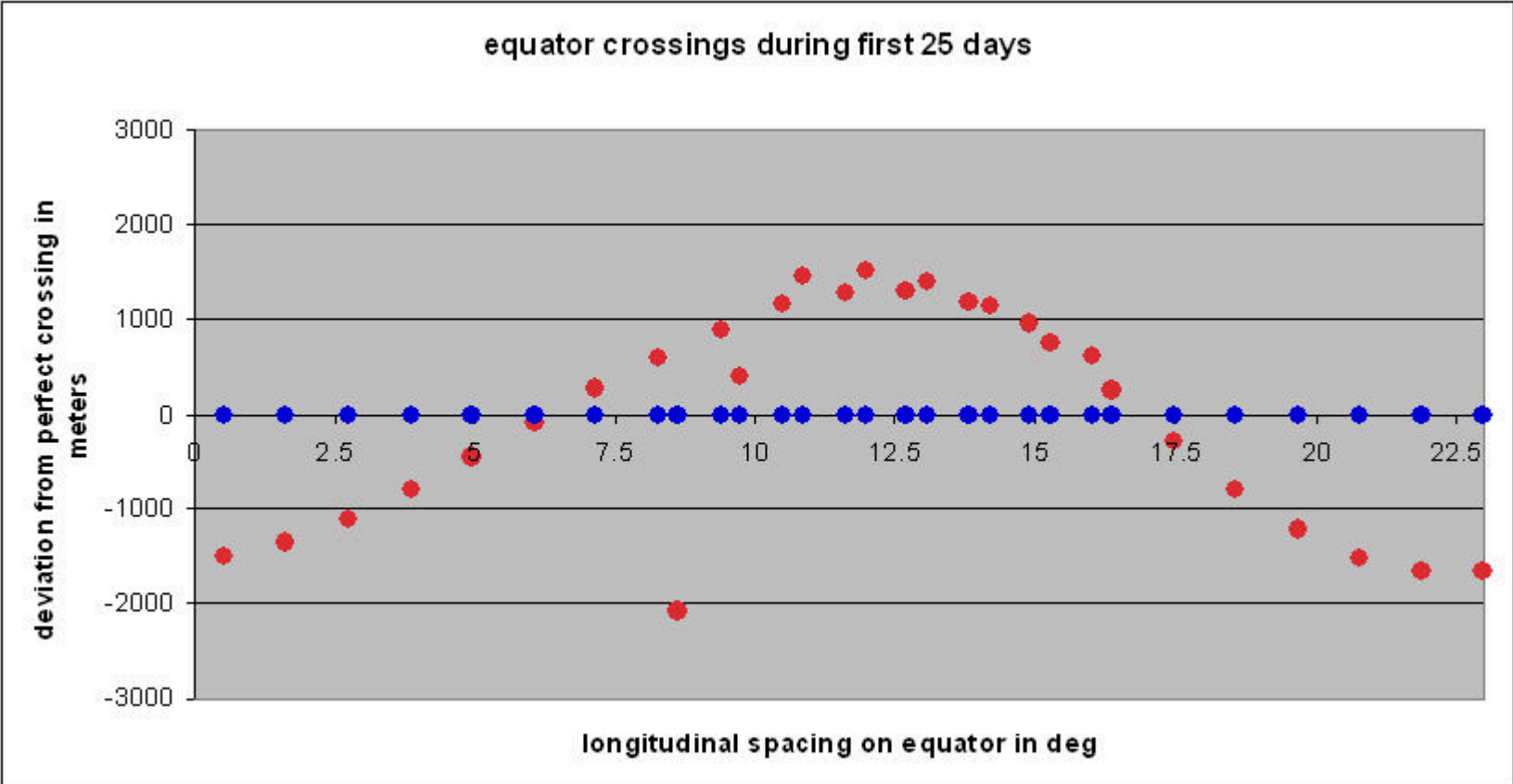


orbit altitudes vs. ground repeat cycle duration

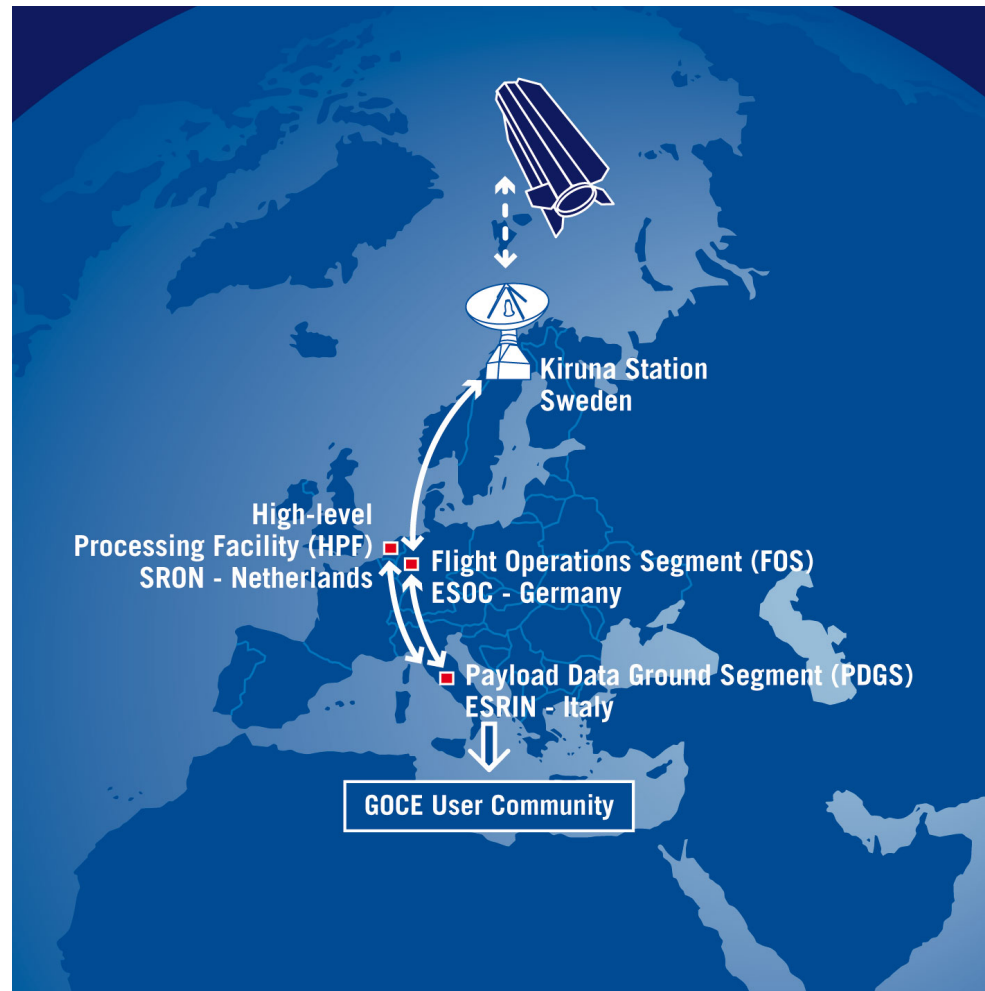
Mission status and performance



bin width on equator of 0.4 deg corresponds to about 40 km, we move about < 2 km around centers of adjacent bins, and this "error" is due to Earth's geopotential, not a drag-free control residual error



Ground Segment



Summary and further Planning



- Satellite and Payloads are performing very well
 - No redundancies used, no failures on board
 - Plenty of power and consumables
 - Science operations can be continued all year throughout long eclipse phase
 - Current altitude may most likely be kept till late 2010
 - Mission extension technically feasible
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 www.esa.int/esaLP/LPgoce.html