A COMPACT LRI FOR CUBESAT PLATFORMS

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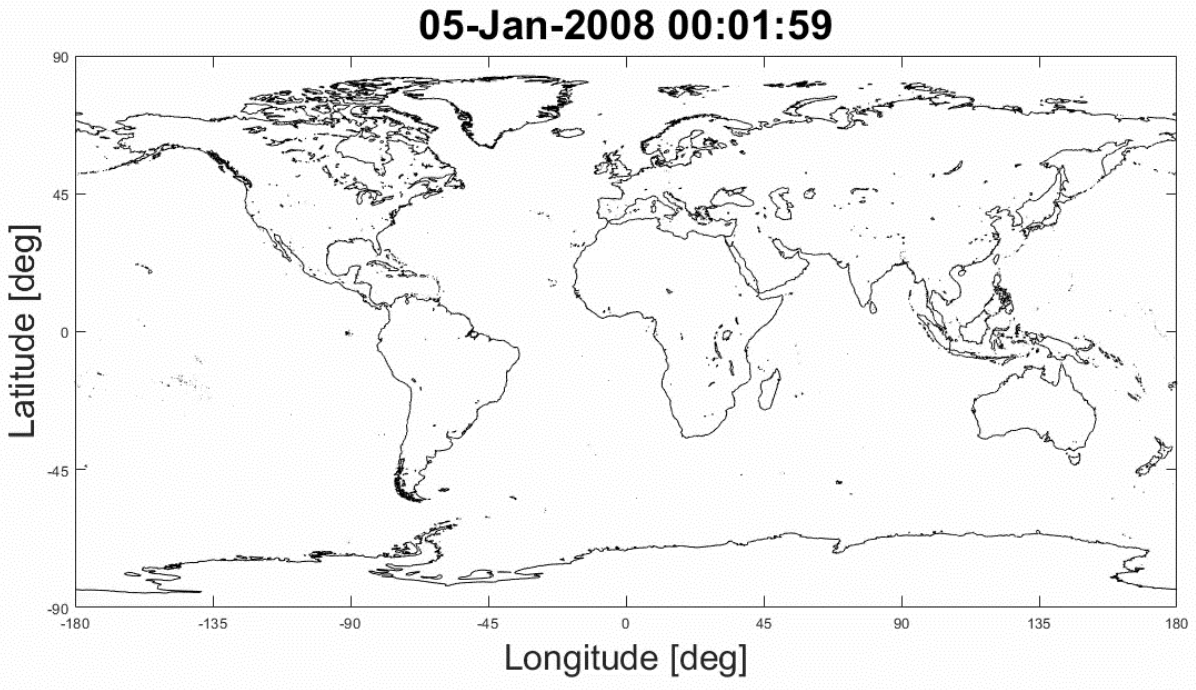
Ground-Track Coverage

GRACE-FO



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Ground-Track Coverage

GRACE-FO

SENSORIS

Joint project between:

- DLR
- ZARM, Bremen
- Insititute of Aerospace Technology, City University of Applied Sciences Bremen

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Ground-Track Coverage

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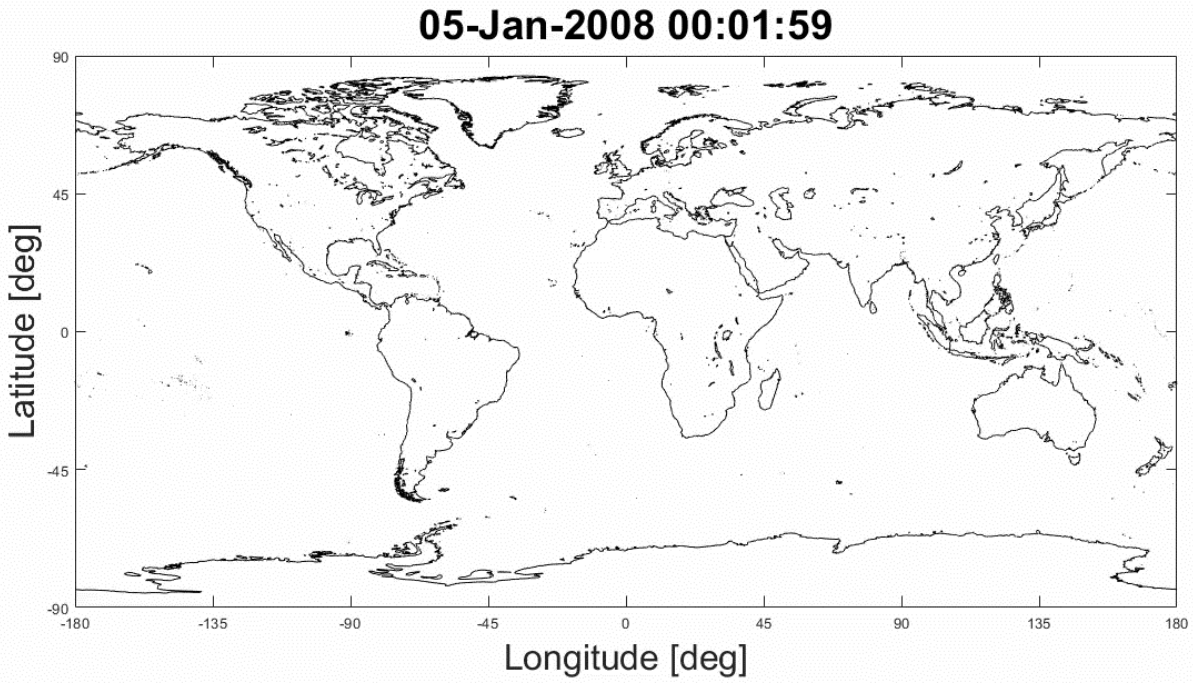

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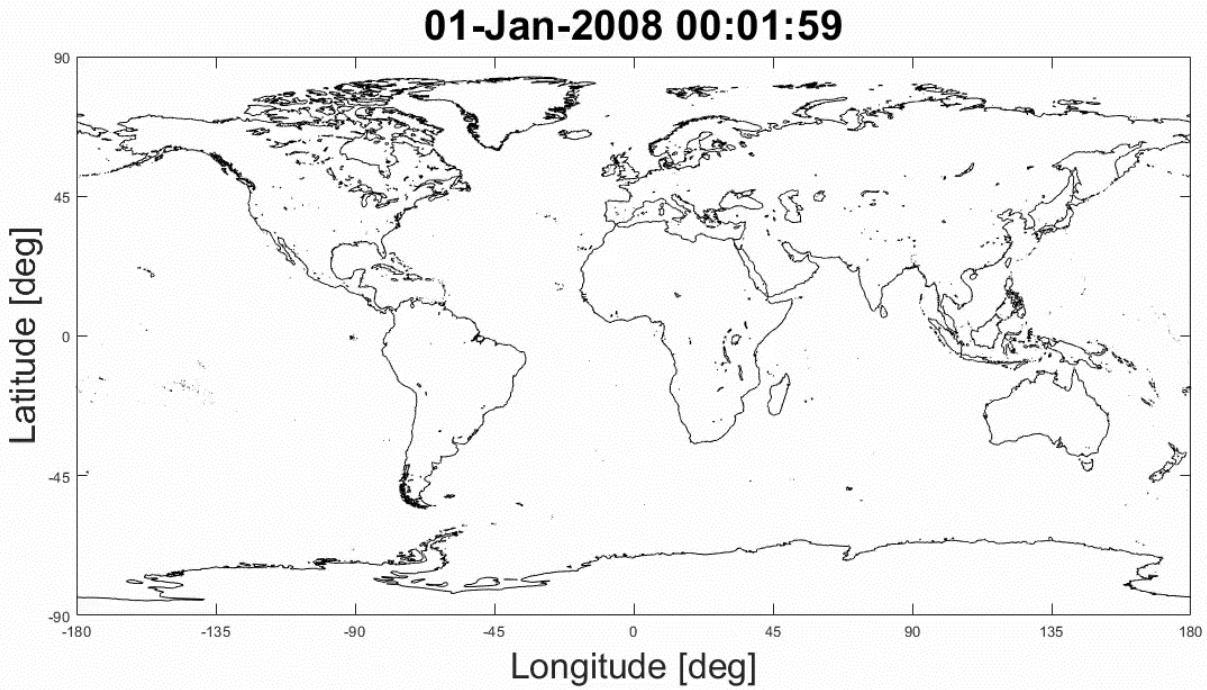

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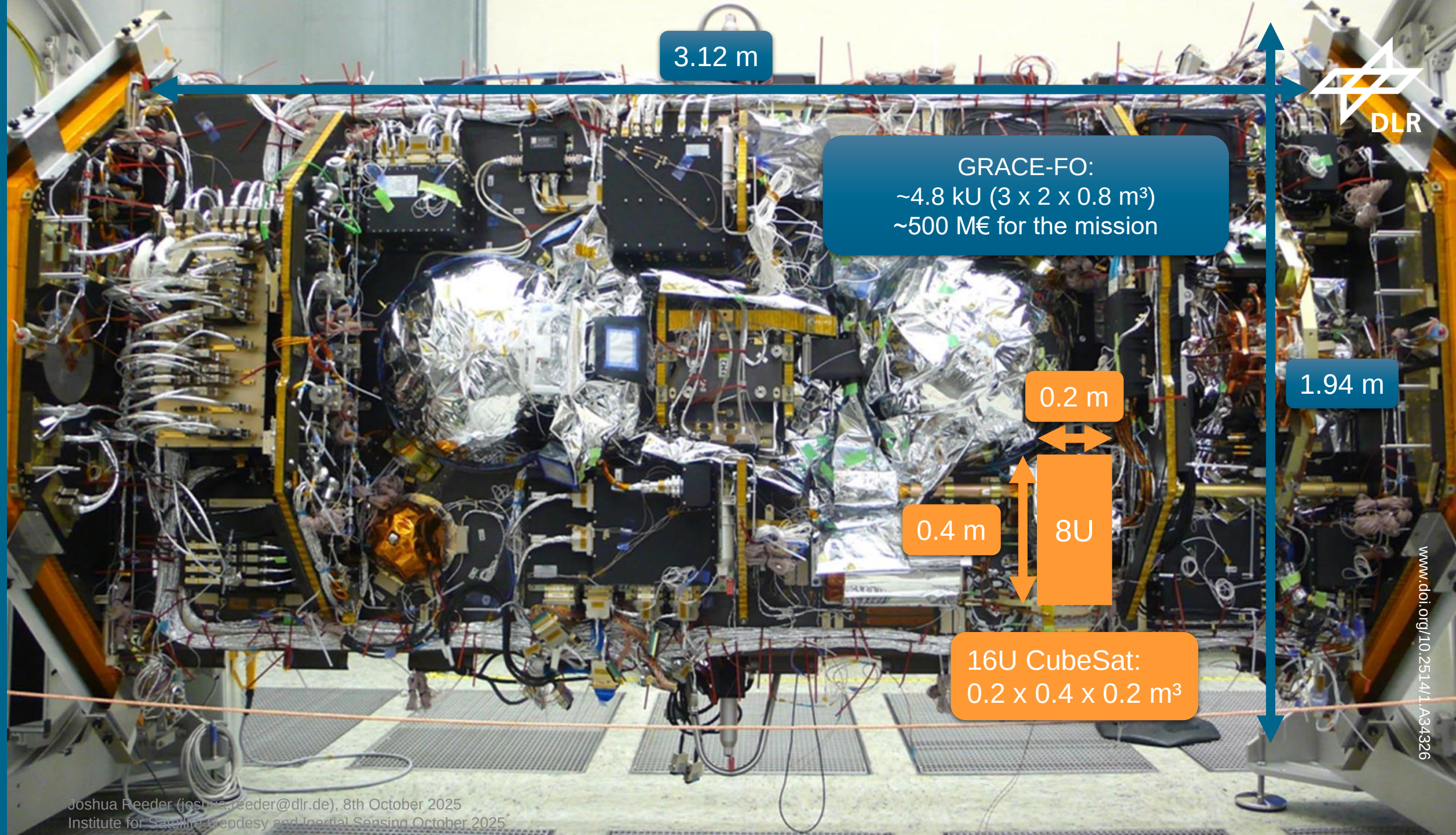

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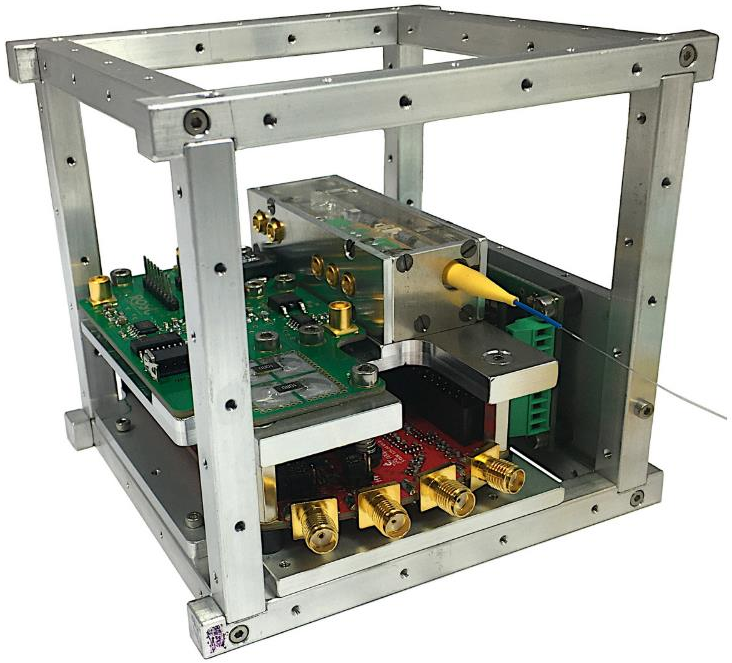
Compact LRI for CubeSat Platforms

Envisioned Requirements

- 16U Cubesat
- Performance: $< 1 \frac{\mu m}{\sqrt{Hz}}$ (better than GNSS
  - (GRACE-FO: $< 80 \frac{nm}{\sqrt{Hz}}$)

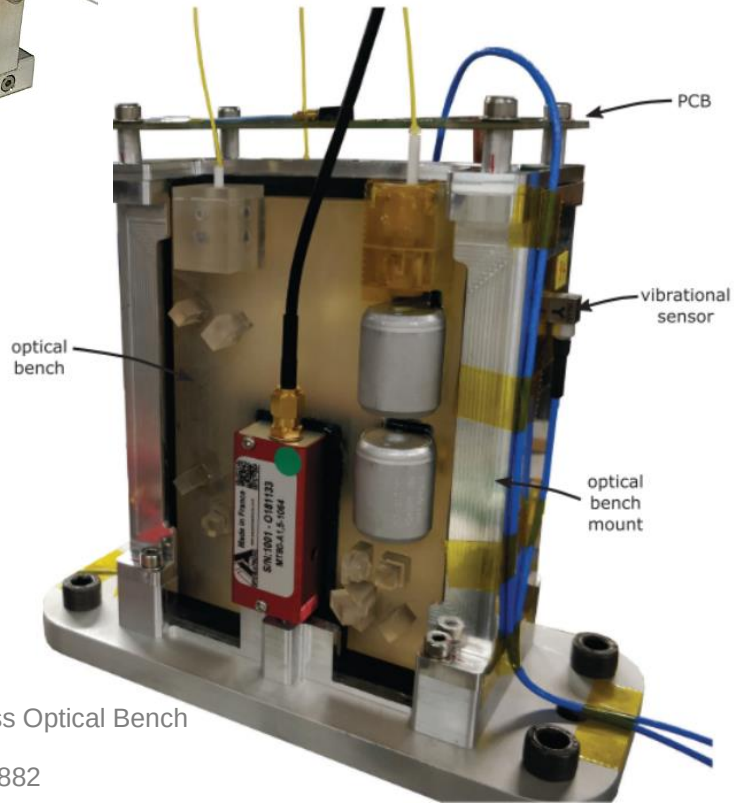
Trade-Offs and Technology

- Wavelength
- Laser Frequency Stabilisation Method
- Thermal Environment → Low CTE Glass Breadboard



<1U Rubidium Frequency Reference

https://doi.org/10.1364/JOSAB.420875



Micro-Integrated Low CTE Glass Optical Bench

https://doi.org/10.1117/12.2690882

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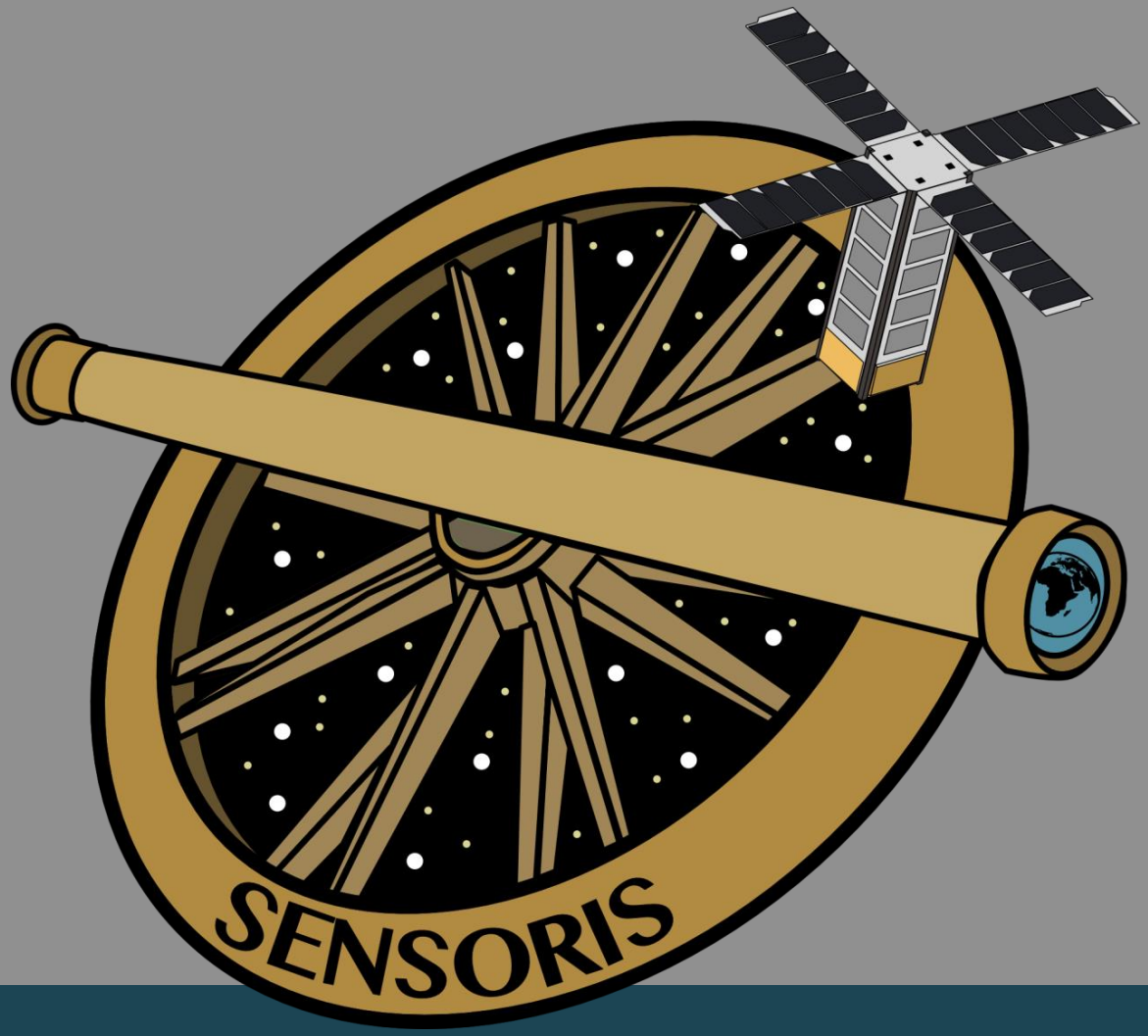

THANK YOU!

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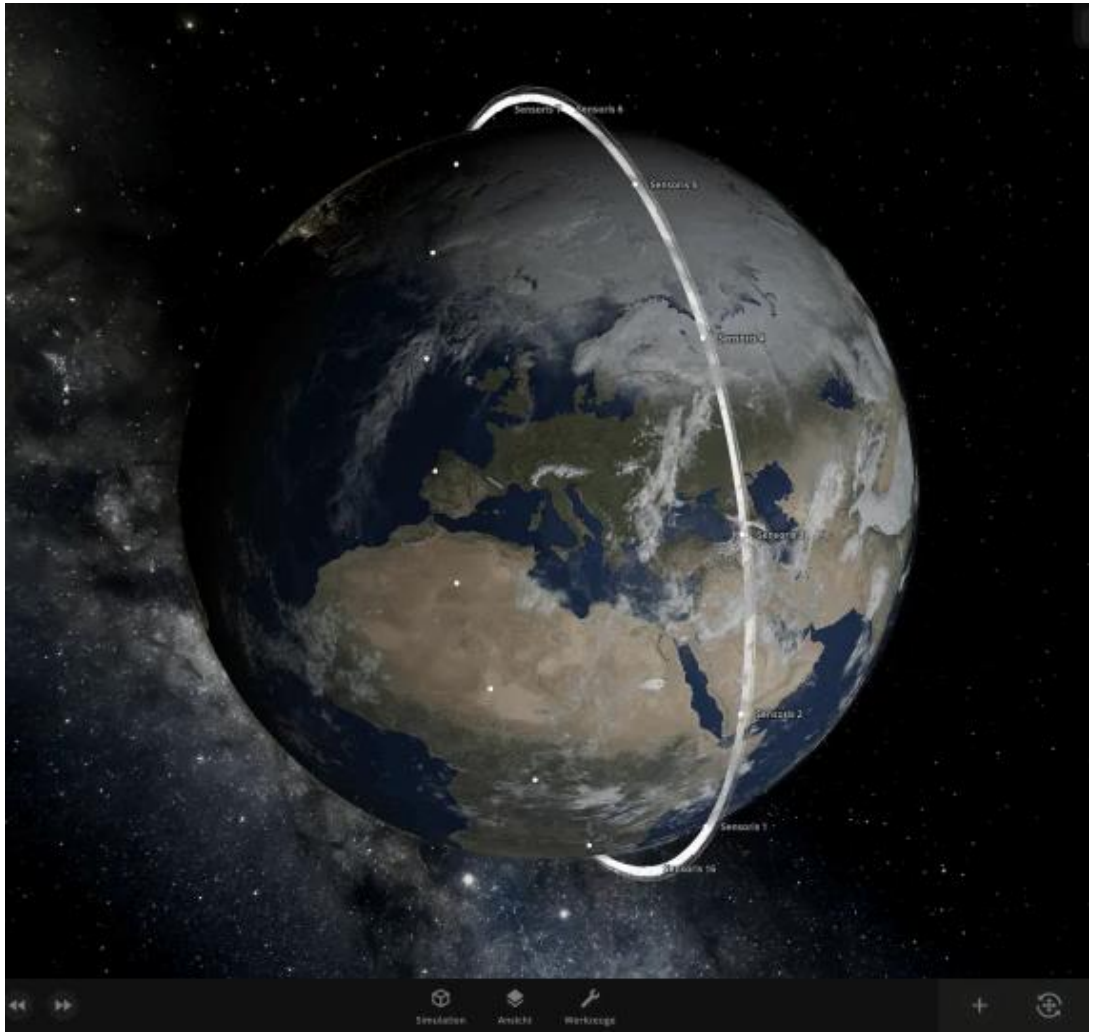
SENSORIS

- Polar Low-Earth Orbit
- Initially 16 Satellites
  - Evenly distributed over the same orbit (TBD)
- High-low Satellite-to-Satellite Tracking
- GNSS as primary observation
  - Accelerometery Optional
- Technology Basis:
  - VIBES Pioneer 3U cubesat
  - New Space approach
  - Commercial off the shelf components



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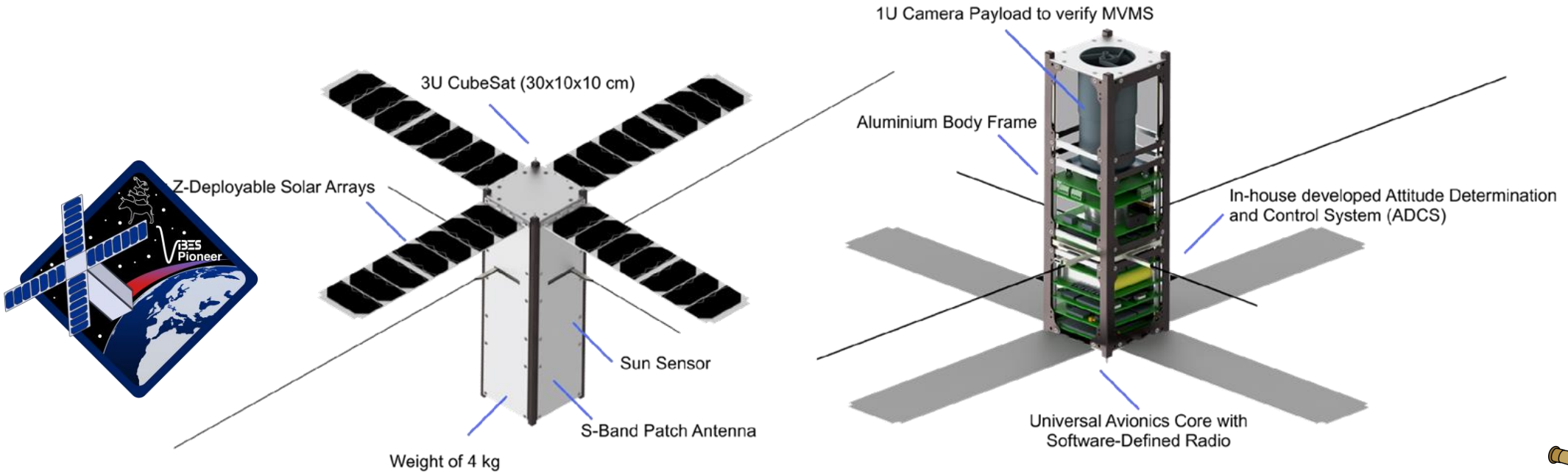
Technological Basis: VIBES Pioneer

- Bremen‘s 1st Student-Built Satellite to improve the optical performance of spacecrafts using consumer electronics
- Launch scheduled for 2025 to a 500km polar SSO



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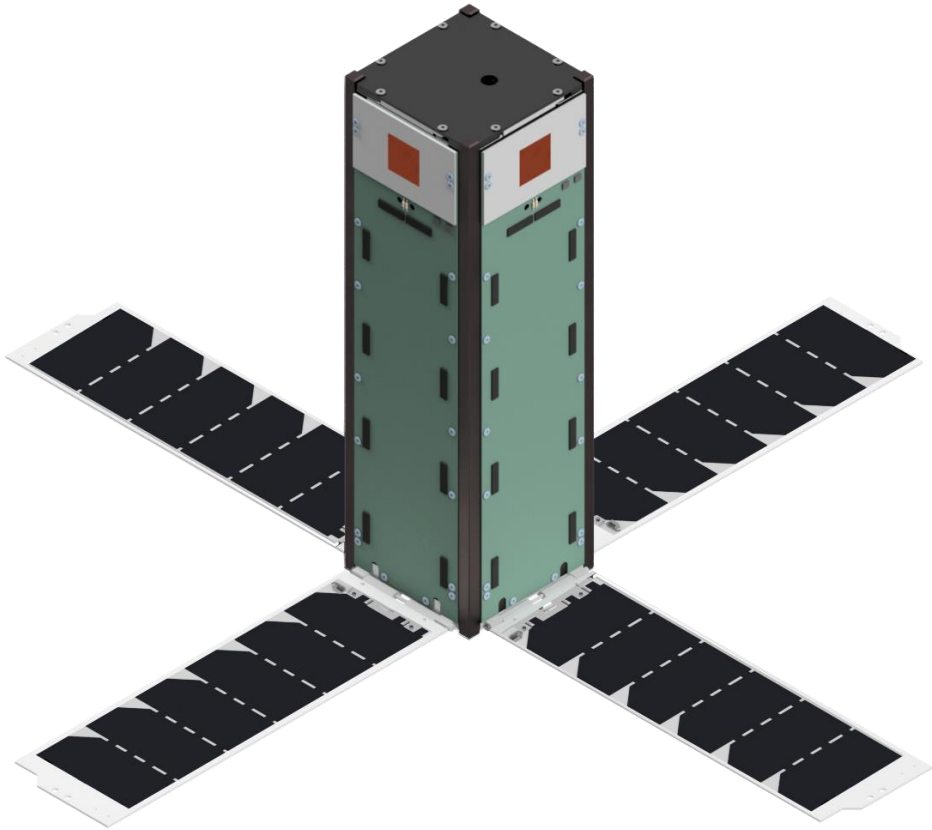
SENSORIS Next Steps



- 9 month feasibility study (starting November):
  - Usability and TRL of consumer electronics
  - Adaption of VIBES Pioneer
  - Orbital configuration including number of orbital planes
  - Payload requirements
  - Accelerometry
  - Performance
- Implementation phase of 3 years
- Long-term Goals:
  - Scalability: Use 64+ satellites to increase to half- or quarter-daily gravity solutions → directly measure tidal effects
  - Implement accelerometry using quantum technology
  - Implement low-low satellite-to-satellite tracking (LL-SST)

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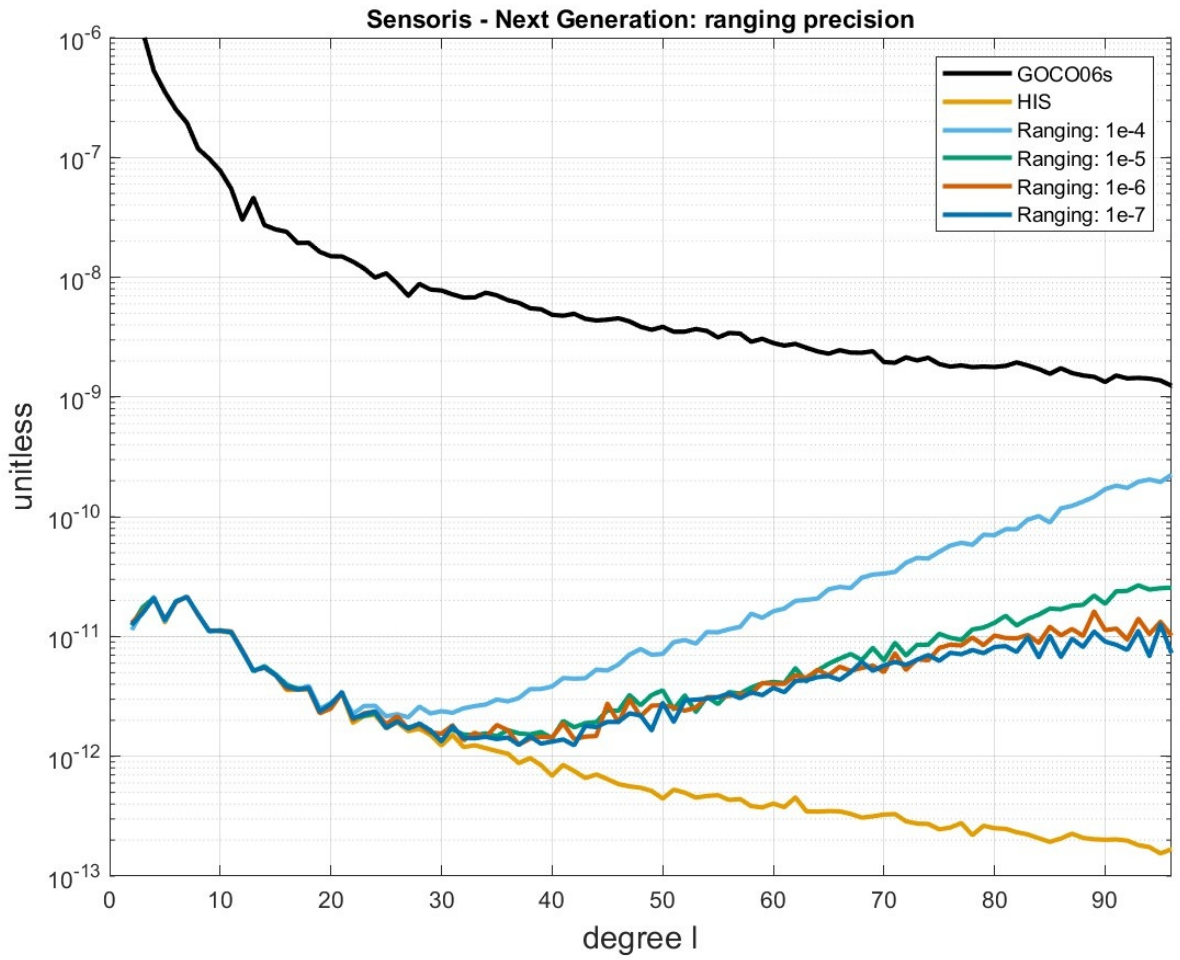
SENSORIS – Ranging Precision

- Comparison of spherical harmonic degree RMS signal
- Black = static field
- Yellow = HIS signal we want to measure
- Others: Solutions for different levels of precision of ranging measurement



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Imprint

Topic: **A Compact LRI for Cubesat Platforms**

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