Appendix K

Thermal experiments on LISA Pathfinder's Inertial Sensors

Ferran Gibert (University of Trento, Italy)

Abstract

LISA Pathfinder is an ESA mission with NASA collaboration aimed to test key technologies for a future space-based gravitational wave detector. The main objective of the mission is to demonstrate that two free-falling masses can be controlled inside the satellite with an unprecedented residual relative acceleration of less than 10 $\text{fm/s}^2/\text{sqrt}(\text{Hz})$ in the band around 1 mHz.

Among other kind of noise sources, temperature fluctuations can potentially play an important role in the experiment, since variations of temperature around the masses produce forces on them via three thermal effects: radiation pressure, outgassing and the radiometric effect. In order to keep these temperature-induced forces monitored, the instrument is equipped with series of high precision temperature sensors and with heaters that allow to inject characterization signals to the system.

Following to its successful launch in December 2015, the satellite started scientific operations in March 2016, and since then different thermal characterization experiments have been performed on the satellite's Inertial Sensors. In this presentation we will describe these experiments and report on the current status of their analysis.



- 2. LISA Pathfinder
- 3. Thermal diagnostics subsystem
- 4. Thermal experiments on the Inertial Sensors
- 5. Preliminary results
- 6. Overview



Credits: Airbus Defence and Space

30th European Space Thermal Analysis Workshop





30th European Space Thermal Analysis Workshop

5–6 October 2016, ESTEC

6







133









[Preliminary] results

- Data analysis tool: a dedicated LTPDA Toolbox developed by the data analysis collaboration to provide a common analysis framework for all the LPF experiments, in MATLAB environment
 - Specific methods for time-domain and frequency-domain objects.
 - Keep history of all actions applied in final products
- Analysis pipelines for each experiment based on LTPDA.
- Also used in many labs for data processing and analysis.



Download it in https://www.elisascience.org/ltpda/

30th European Space Thermal Analysis Workshop







