

Planck/LFI Ground Tests: data management and analysis

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Ground Tests are a fundamental milestone within the development of the Low Frequency Instrument (LFI) which will fly onboard the ESA satellite Planck. They allow the collection of information which can not be supplied by monitoring onboard activity of the satellite during operations. Here methods and principles driving the management and elaboration of data collected during the Ground Tests campaign for the Planck / LFI are synthetically presented. Ground Tests take place in LABEN (Milano) and will last for about one year.

Ground Tests for Planck/LFI

Ground Tests are a fundamental milestone within the development of LFI.

They allow the collection of relevant information for

1. validation of the instrument,
2. instrument setup.

These information will increase the value of the data collected during the flight, allowing a better calibration and a more powerful diagnostic.

The information produced during ground tests contribute to the quality of the scientific results of the mission.

All the information generated by the ground tests has to be collected and stored within the Instrument Ground Segment (which will be in charge for data analysis and instrument control during the mission), ready to be retrieved and analyzed along all the life of the mission for instrument calibration and diagnostic.

Ground testing is a multi site activity involving on the same foot: the Industries, the Instrument Consortium and the Instrument Data Processing Center (DPC).

Ground Tests Operations

Radiometric chains will be tested one by one and after their final integration in the instrument. Tests are carried out inside a *Cryostatic Facility* where the flight environment (vacuum, thermal and electrical conditions) will be simulated. The Cryo.facility allows programmed variations of part or all of the parameters defining the environmental conditions.

Each test, aimed at assessing a specific feature of the instrument, is characterized by:

1. the hardware/software configuration (including the configuration of the facility).
2. the set of constant parameters and the laws by which variable parameters are changed.
3. the results of the test.
4. assessment of proper execution of telecommands for specific operations.
5. a synthetic report on the test (e.g.: "good", "bad", "failed", etc.).

Overview of the ESA Planck Mission

The ESA satellite Planck, is the 3rd generation of CMB space missions (after COBE and WMAP) designed to produce measurements of temperature anisotropy over full sky. It carries two instruments: the Low Frequency Instrument (LFI) and the High Frequency Instrument (HFI).

- Full sky surveyor in Solar-Earth L2
- Dedicated to CMB and (sub)mm astronomy
- 1.5 m telescope, 5 - 30 arcmin resolution
- Two instruments:
LFI: 30 ÷ 70 GHz, HFI: 100 ÷ 857 GHz

- Launch planned February 2007
- At least 14/21 months mission (2/3 surveys)
- Sky scanned in "nearly" great circles, orthogonal to ecliptic, 24 per day



Requirements for the Handling of Ground Tests Information

Requirements for Data Handling are:

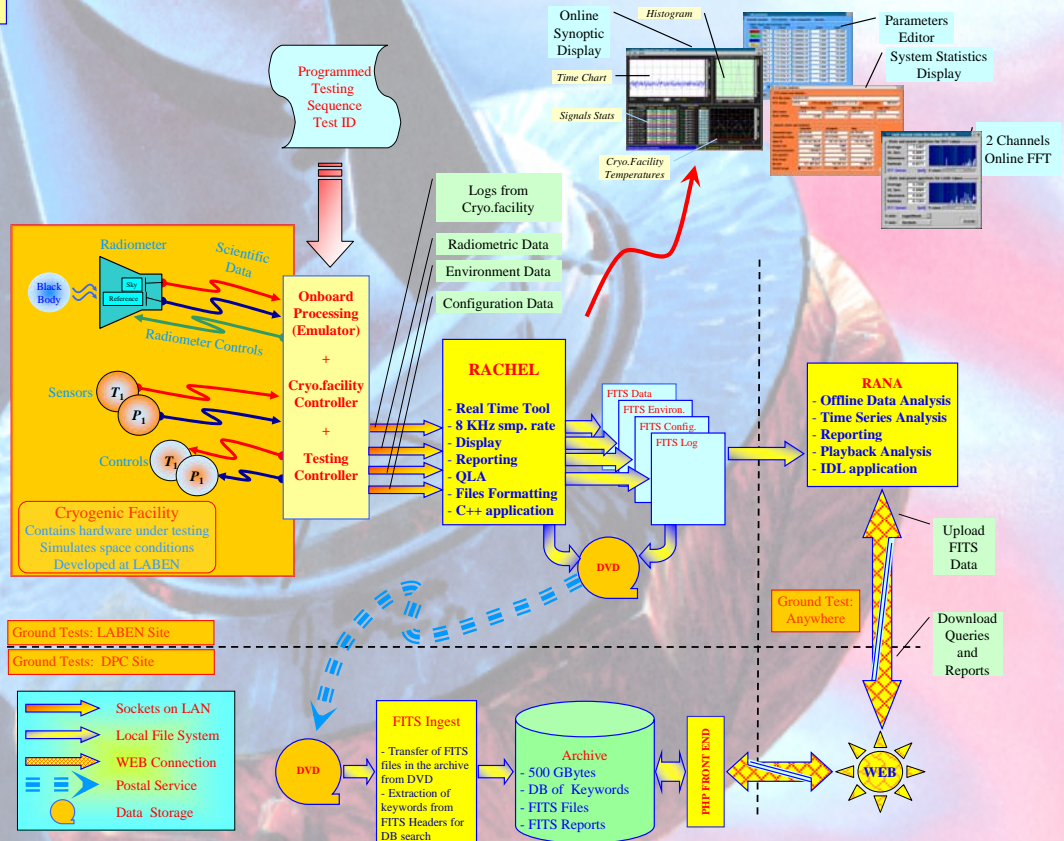
1. Fast and effective analysis of results during the test campaign.
2. Maximize flexibility for the future use of the information acquired during the ground test.
3. To allow the traceability of the conditions of each test as its history years after the end of the test campaign.
4. Retrieval of data from tests by keyword search.
5. To allow retrieval and traceability of results of any analysis accepted as relevant by the consortium, whether performed or not during the test campaign.

Handling of Ground Tests Information

To cope with these requirements data are analyzed online through a local facility (RACHEL) installed at the testing site. In addition RACHEL has the task to integrate the various sources of real time information and to store them in a local data store.

Post processing archival of data is accomplished at the Instrument DPC, ingesting an *Archive* through a *FITS Ingestor* with the data produced by RACHEL. FITS files are provided on DVD delivered by the postal service. The Ingestor extracts from RACHEL files all the needed keywords required to prepare tables for fast retrieval of data.

More accurate offline analysis are performed by the RANA tool from either RACHEL FITS files or from the archived data. Once consolidated, the results of RANA as the connected documentation are stored in the DPC Archive. Storage of RANA output follow rules similar to those used for the RACHEL products, in order to allow full traceability of these products as to link each result to the version of RANA which has been used to obtain it.



Partners, Sites, Responsibilities

LABEN - Milano - Italy:	integration and testing
IASF - Milano - Italy:	RANA, offline analysis, scientific support
INAF / OAT - Trieste - Italy:	Test data archive, scientific support
IASF - Bologna - Italy:	Rachel
SPACETECH - Tromsø - Norway:	EGSE



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