

10.2.23 WP 6-6X3: LiteBIRD Fase A – Electronics

PROJECT: Studi di Cosmologia		WP REF.: 6-6X3
WP TITLE: LiteBIRD Fase A - Electronics SUB-CONTRACTOR: INFN - Sezione di Pisa START EVENT: KO+18 END EVENT: RA4 WP MANAGER: Giovanni Signorelli		Sheet: 1 of 1 Issue Ref: 1 Issue Date:30/03/2018

OBJECTIVES

The object of thi WP is to develop key ingredients in support to the present electronics and detector design of the LiteBIRD satellite during phase A.

As for the electronics is concerned a basic design of the instrument block diagram exists but a comprehensive scheme encompassing all the needed interfaces and interlinks is still missing.

INPUTS

- LiteBIRD mission description and requirement documents
- Work plan & schedule

TASKS

- Study and implementation of an overall design for the instrument electronics;
- Contribution to the design of the warm electronics unit in particular to the data compression electronics (DCE).

Concernig this latter in particular a fundamental aspect is the removal of electronic glitches induced by cosmic rays in the sensors therefore we would like to study the possibility of performing test beam studies on the experiment's detectors at dedicated proton beams in European laboratories (PSI, CERN, DESY) as a necessary and complementary part to the detector development.

OUTPUTS

Contribution to deliverable documents regarding:

- overall architecture of the electronics with particular emphasis on items that could be taken care of by the italian community;
- blueprint of the overall electronics architectural design with particular emphasis on the system development accross different institutions;
- decision on the possible sharing of duties on the design and realization of the read-out electronics, with particular emphasis on the specialization towards the High Frequency Telescope;
- design test facilities for the various electronic pieces;
- operational design of possible test station for testing the sensors with protons of several GeVs to simulate cosmic-ray interactions, including cryostat and readout, beam-line setting and comparison of available beam-lines;
- investigation of possible industrial partners for the production of readout, houskeeping and data compression electronics;
- costing of the realization of the above-mentioned contributions.

SCHEDULE

Activity completed at RA3



10.2.24 WP 4-6X3: LiteBIRD Fase A – Thermal analysis

PROJECT: Studi di Cosmologia		WP REF.: 4-6X3
WP TITLE: LiteBIRD Fase A - F Mechanical and Thermal Studies SUB-CONTRACTOR: INAF/OAS Bologna START EVENT: KO+18 END EVENT: RA4 WP MANAGER: Gianluca Morgante		Sheet: 1 of 1 Issue Ref: 1 Issue Date: 30/03/2018

OBJECTIVES

This WP is aimed to the characterization of the thermo-mechanical and cryogenic behavior of the LiteBIRD High Frequency Telescope (HFT). The whole HFT sub-system is required to operate at cryogenic temperature ($T \leq 5$ K). The activity will be at first focused on supporting the trade-off analysis between the possible optical prescriptions to contribute to the baseline selection. Afterwards the WP task will be centered on the optimization of the HFT thermo-mechanical design and analysis by detailed simulations.

The main objectives of the Thermal Analysis WP can be summarized as follows:

- Participation and support to the ESA Concurrent Design Facility (CDF) study on the High Frequency Telescope (HFT) on board the LiteBIRD mission
- Trade-off analysis of the thermo-mechanical configuration of the proposed optical designs of the LiteBIRD HFT
- Materials and technical solutions analysis for the optimization of the HFT thermal design
- Thermo-mechanical design, modeling, analysis and optimization of the LiteBIRD HFT selected baseline

INPUTS

- LiteBIRD mission description and requirement documents
- Work plan & schedule
- HFT mechanical requirements & allocations
- HFT thermal and cryogenic requirements & allocations
- HFT optical requirements
- Preliminary HFT thermo-mechanical configuration (CAD files)
- Preliminary materials assumptions

TASKS

The study will be carried out on the basis of an analytical approach centered on careful mechanical and thermal modeling activities, on the requirements definition and on suitable materials and technical solutions analysis:

- Review of the up-to-date thermo-mechanical design and assumptions on the proposed optical configurations
- Materials study for each solution
- Identification of the critical issues for the thermo-mechanical design

- Support the CDF study in the trade-off analysis of the optical configurations
- Coordination of the Thermo-Mechanical WG within the HFT European Joint Study Group
- Coordination of Italian industrial support to the thermo-mechanical activities
- Optimization of the mechanical design of the HFT selected baseline
- Mechanical model and analysis
- Optimization of the thermal design of the HFT selected baseline
- Thermal model and analysis
- Evaluation of HFT interaction with LiteBIRD cryochain
- Thermo-elastic analysis
- Thermo-mechanical system engineering
 - Definition and optimization of the thermo-mechanical interfaces and requirements flow-down
 - Loads and dissipations at the thermo-mechanical interfaces
- Finalization of materials selection and technical solutions for the optical units and structures
- Support to AIV plans preparation at system and sub-system level
- Contributions to programmatic
- Preparation of relevant documents and reports
- Support to ESA and JAXA project reviews

OUTPUTS

Contribution to deliverable documents regarding:

- Thermo-mechanical design of the HFT baseline
- Structural model (FEM)
- Thermal mathematical model
- Thermo-elastic analysis
- Thermal control hardware specifications
- Study reports and technical documentation:
 - Mechanical analysis and modeling report
 - Thermal analysis and modeling report
 - Thermo-mechanical interfaces definition and description
 - Contribution to trade-off tables and documents
 - Contribution to AIV planning documents
- Scientific publications

SCHEDULE

Activity completed at RA3