10.2.20 WP 2-6X3: LiteBIRD Fase A – HFT Test and calibration

PROJECT: **Studi di Cosmologia**		**WP REF.: 2-6X3**
WP TITLE: **LiteBIRD Fase A - HFT Test and calibration** **SUB-CONTRACTOR**: **Dipartimento di Fisica – Università di Milano** **START EVENT**: KO+18 **END EVENT**: RA4 **WP MANAGER: Marco Bersanelli**		**Sheet**: 1 **of** 1 **Issue Ref**: 1 **Issue Date**:30/03/2018

OBJECTIVES

This WP covers the testing and calibration of the HFT, a 20-30cm aperture telescope on board the LiteBIRD satellite.. We will concentrate on the test and calibration of the HFT telescope subsystem (not including HWP) for the baseline reflector design. For comparison, subsystem testing of a backup refractor case. Contribution to the overall LiteBIRD calibration effort during Phase A1 will be provided.

The PLANCK experience has demonstrated that the success of a high precision CMB mission crucially depends on the completeness and accuracy of instrument test and calibration, both on the ground and in-flight. In fact, the new generation of CMB measurements, such as the planned LiteBIRD polarization survey at large angular scales, are likely to be limited by residual systematic effects rather than white noise. This requires full characterization of all the key instrumental parameters at system and subsystem level. The Phase A1 design study of the LiteBIRD HFT, therefore, must include a thorough plan of its optical characterization.

INPUTS

- LiteBIRD mission description and requirement documents
- Basic optical and thermo-mechanical design of HFT
- Work plan & schedule

TASKS

Parameters to be measured and their requirements: identify and report the instrumental parameters. This will include main/intermediate beams, far-sidelobes, co- and cross-polar components, beam variations within bandwidth; strategy for in-flight beam reconstruction. Definition of requirements for each parameter. In general, the requirements will be provided as an input from either WP1 (Telescope Design) or from system level design (JAXA, LiteBIRD Team).

Study of measurement techniques: for each parameter test, one or more measurement techniques will be identified. A key part of our Phase A1 study will be to perform a trade-off analysis among them, including the associated risks. The most suitable measurement technique will be identified and a preliminary test procedure will be produced. A discussion of the extent to which each parameter will be measured also in flight will be included.

Definition of needed H/W and facilities: the needed H/W and facilities for the test execution will be identified, aiming at an optimal overall scheme. This will be done keeping in mind the possibility of sharing facilities not specifically designed for optical calibration tests (e.g. thermal-vacuum chambers) with RF, thermal tests; Identification of opportunities for Italian participation in the actual optical testing (institutes, industrial partners) in post-phase A activity.

Schedule and Milestones: the timing of the actual optical test campaign will be closely connected to the relative milestones. It will be harmonized with the system test plan for HFT and with the overall LiteBIRD Project schedule. In general, during Phase A1 and beyond, our activity will be closely coordinated with the Japanese team and with other European partners.

Costs: the costs and risk associated with the test setup, both preparation and execution, will be estimated.

OUTPUTS

Document describing the overall plan for the HFT optical testing (HFT Optical Testing Document - HOTD) including

- identification of the optical parameters to be measured according to the requirements for in flight configuration and in ground testing conditions
- definition of optimal measurement techniques
- measurements method and trade-off between different options.
- preliminary plan for detailed test procedures
- definition of needed H/W and facilities.
- definition of interfaces with other HFT instrument tests (besides optical testing) requiring similar test environment (cryogenic thermal-vacuum), in coordination with LiteBIRD management and other European partners
- schedule and milestones of the HFT optical test plan
- costs and risk analysis of the HFT testing activity (including personnel, H/W, facilities, etc.)
- Preparation of realistic optical performance as an input to simulations of instrument systematic effects

SCHEDULE

Activity completed at RA3