

# Science Management Plan for the combined Planck and FIRST mission

15 September 1997

## Foreword

Planck (formerly known as COBRAS/SAMBA) was selected in November 1996 by ESA's Science programme Committee (SPC) to become the 3rd medium-sized mission (M3) in the Agency's Horizon 2000 programme of scientific missions. The Science Management Plan of Planck (ESA/SPC(97)27) was approved by SPC in June 1997.

The Far Infra-Red and Submillimetre Telescope (FIRST) mission is the fourth Cornerstone mission in the Agency's Horizon 2000 programme. The Science Management Plan of FIRST (ESA/SPC(97)22) was given preliminary endorsement by SPC in June 1997, and is expected to receive final approval in September 1997.

A number of similarities between Planck and FIRST have prompted ESA to study the possibility of combining the two projects. The aim of this document (the Science Management Plan for the combined Planck and FIRST missions) is to outline the management scheme which will be used to achieve the scientific objectives of Planck and FIRST in the scenario in which the two missions are combined, up to and including the post-operations phase. This plan does not describe in detail the management of payload or instrument development, which will proceed in parallel.

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# 1 Introduction

The technical solution which enables the combination of the Planck and FIRST missions consists of a single spacecraft bus supporting two completely separate payload modules (the Planck and FIRST PLMs). Each of the two PLMs includes a telescope and a set of instruments:

- the **Planck PLM** consists of a 1.5 m offset Gregorian telescope and two instruments (the Low Frequency Instrument - LFI, and the High Frequency Instrument - HFI). The instruments share the focal plane and an active cooling system.
- the **FIRST PLM** consists of a 3.5 (TBC) m diameter Cassegrain (or Ritchey-Chrétien) telescope feeding three instruments located inside an ISO-type cryostat (a bolometer instrument - the BOL, a photoconductor instrument - the PHOC, and a heterodyne instrument - the HET).

The combined spacecraft will be put into orbit around the L2 Lagrangian point of the Earth-Sun system, from which location it will carry out the observing programmes of both Planck and FIRST.

Apart from their reliance on the same bus to provide spacecraft resources (power, pointing, telemetry and command, etc), the two PLMs are essentially independent of each other. On the other hand, the nature of the two missions is quite different, Planck being a survey of the whole sky carried out while the spacecraft is spinning, while FIRST is a pointed observatory. These two facts indicate that it will be necessary to operate the spacecraft in a 'time-shared' manner, and to carry out the two missions independently of each other.

As a consequence of the independence of the two missions, most of the elements described in the Science Management Plans of each of them can and will be preserved. This document addresses three main points:

- the composition and functions of an 'umbrella' Science Team, to be referred to as the FIRST/Planck Science Team (FPST);
- a coordinated project development and implementation plan;
- a coordinated schedule of operations.

These points are addressed in the following sections.

It is here noted that in case of conflicts between this document and either the Planck or FIRST Science Management Plans, this document will take precedence.

## 2 The FIRST/Planck Science Team

In addition to the separate FIRST and Planck Science Teams (cf. respective SMP), a FIRST/Planck Science Team (FPST) will be formed after the AO process has been completed, and will remain in place until the end of the post operational phase of both Planck and FIRST. The FPST will include 13 persons in its membership, all of whom belong to either the Planck or the FIRST Science Teams:

- The Project Scientists of Planck and FIRST, who will co-chair the FPST;

- From each of the Planck Instrument Consortia: the Principal Investigator (PI), and the Survey Scientist (SS);
- From the Planck Telescope Provider: the Principal Investigator (PI);
- From each of the FIRST Instrument Consortia: the PI and co-PI.

In general, the role of the FPST will be to maximize the scientific return of both Planck and FIRST within the boundary conditions of the combined mission, while at the same time ensuring that the development of the mission remains compatible with the main scientific objectives of both Planck and FIRST. The FPST will be required to monitor and advise on any scientific issues that affect both Planck and FIRST during all phases (development, operations, and post-operations) of the combined mission.

Other members of the Planck and FIRST Science teams, as well as ad-hoc experts, will be invited to attend FPST meetings as the need arises. The members of the FPST will have to provide their own funding to support their activities as such, and in particular will pay their travel expenses when attending meetings of the FPST. This applies as well to any other members of either the Planck or FIRST Science teams who contribute to the work of the FPST, with the exception of the FIRST Mission Scientists. For FIRST Mission Scientists, as well as for ad-hoc experts not belonging to either of the FIRST or Planck Science Teams, ESA will cover these expenses.

### 3 Project Schedule

The schedule for the combined FIRST/Planck mission, including the AO cycle and the programme milestones are given in Table 1.

Issue of the Announcement of Opportunity (AO)	30 Sep 1997
Submission of questions for clarification	31 Oct 1997
General clarification meeting	18 Nov 1997
Proposals due	16 Feb 1998
Evaluation phase	Feb → May 1998
Clarification and optimisation meetings	Mar → Apr 1998
Final recommendation by eval. committee	End Apr 1998
AWG/SSAC review	May 1998
SPC selection of payload(s), PIs and First Mission Scientists	28/29 May 1998
Issue ITT for Phase B & CD	Mar 1999
Phase B & CD	Apr 2000 → Jul 2005
Instrument EM deliveries	Apr 2002
Instrument PFM deliveries	Jan 2004
Instrument FS deliveries	Jan 2005
Flight acceptance review	Jul 2005
Launch	Dec 2005

Table 1: FIRST/Planck AO cycle and overall programme schedule.

## 4 Operations

The observatory nature of FIRST implies that it will carry out a large number of observing projects with a wide range of observing times, varying from minutes to months. The longest foreseen programme is a deep survey of part of the sky over a period of several months. There is a requirement that some key FIRST observation programmes are carried out early in the mission. The minimum total observing time specified for FIRST is 3 years.

The goal of Planck is to carry out two full surveys of the whole sky. The time required to complete a single full sky survey depends on the detailed telescope configuration, and may vary between 6 and 7.5 months. It is a requirement that each single full sky survey be carried out continuously (i.e. without interruptions). It is also a requirement that the entire Planck observation programme is carried out in the early part of the FIRST/Planck mission.

Planck and FIRST will share the observation time of the combined FIRST/Planck mission according to the following schedule:

1. Satellite commissioning and performance verification phases (TBD months)
2. Predefined science demonstration (0.5 to maximum 1 month)
3. Planck first full sky survey (6 to maximum 7.5 months)
4. FIRST key programmes (7 to maximum 8 months)
5. Planck second full sky survey (6 to maximum 7.5 months)
6. FIRST observations until end of in-orbit phase

This means that with a Planck single full sky survey time of 6 (7.5) months the entire Planck observation programme will be completed within 21 (24) months after the successful conclusion of the satellite commissioning and performance verification phases.

Any changes proposed to this schedule, which may only arise following a major anomaly in orbit, will be reviewed and agreed to by the FPST, which must ensure that the scientific programmes of both missions (Planck and FIRST) are carried out in a timely manner.

The minimum total required observation time for the combined mission is thus between 4 and 4.25 years. In addition to this, time is required for instrument commissioning (1 month, TBC) and performance verification (PV, 2 months, TBC). It is likely that part of the PV phase has to be repeated when one of the two payloads has been 'dormant' for some time before it is turned on again. Consequently the absolute minimum total time of instrument operations is 4.5 years.

Note that it is assumed in the observing schedule that during Planck operations the FIRST instruments will be switched off and vice-versa.