

 	HIFI Commissioning Phase Plan	Hifi no.: ICC/2008-122. Inst.no.: n Issue: 1.3 Date: :22-07-08 Category: 2.
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Document Change Record

Date	Issue/Revision	Change
21/02/08	Draft 1.0	First draft.
31/03/08	Draft 1.1	Section 6:
		<ul style="list-style-type: none"> - swapped order of blocks 5 and 6. - removed COP-4-CPR-Scan2 - revised time estimates
		Added appendices
04/06/08	Draft 1.2	<ul style="list-style-type: none"> - Moved 2.1-CPR_RespTime into block 1.2. - Add block 3-Deflux
		- Corrected some typos and removed some confusing constraint statement after phone call with M. Krassenburg
		- Added information about whether the analysis performed on a given sub-block requires HK or Science TM
22/07/08	Draft 1.3	Revised detailed timing of various blocks (1.2-LO_FT, 2.1-DipCal1 and 2.2-DipCal2)
		Removed HIFI-COP-1.2-UPC_FT and added a dedicated IF FP test (HIFI-COP-1.2-IF_FT)

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1 Introduction

This document is the top level document for the Commissioning Phase of the HIFI instrument. It provides the general assumptions and recalls the main objectives of this measurement campaign. It also describes in details each of the activities expected to be performed during the commissioning, their expected timing, and their connection to the uplink tables. Finally, a time-line for the whole activity is proposed.

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2 References

2.1 Applicable Documents

AD1	LRM-ENS/HIFI/PL/2000-001	Calibration Plan for HIFI	Issue 1
AD2	ICC/2001-005	HIFI calibration use cases	Draft 0.3

2.2 Reference Documents

RD1	FPSS-01046	Procedure to verify the structural integrity and the closed loop functioning of the HIFI FPC	Issue 0.3
RD2	HP-2-ASED-RP-0011	H-EPLM Thermal Model and Analysis	5 Draft

2.3 Acronyms

AOT	Astronomical Observation Template
CBB	Cold Black Body
COP	COMmissioning Phase
DBS	Double-Beam-Switch
FPC	Focal Plane Chopper
FPU	Focal Plane Unit
FPG	Focal Plane Geometry
FT	Functional Test
HBB	Hot Black Body
HEB	Hot Electron Bolometer
HIFI	Heterodyne Instrument for the Far-Infrared
HK	House-Keeping
HRS	High-Resolution Spectrometer
ICU	Instrument Control Unit
LOU	Local Oscillator Unit
LSU	Local oscillation Source Unit
MOC	Mission Operation Centre
MOIS	Mission Operation Information System
MPS	Mission Planning System
MTL	Mission Time-Line
PU	Peak-up
PV	Performance Validation
SIS	Superconductor-Insulator-Superconductor
SPACON	Spacecraft Controller
TV/TB	Thermal Vacuum / Thermal Balance
UPC	UP-Converter

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WBS Wide-Band Spectrometer

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3 Objectives of the Commissioning phase

The objectives of the Commissioning phase can be summarized as follows:

- Check the integrity of the HIFI instrument after the launch – in particular check the health and well functioning of all HIFI units
- Assess the optimum engineering settings applicable to each of the HIFI Sub-systems, in particular compare them to the ones derived from the TV/TB campaign – note that this is distinct from the observing mode parameter optimisation, which takes place during the PV-phase
- Characterize the Focal Plane Geometry
- Pre-validate a sub-set of AOT's planned to be used during the PV

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4 Commissioning Phase assumptions

We make the following assumptions:

- The science and HK telemetry produced in the framework of the COP activities can be retrieved from the data-bases via their ObsID and BbID stamps
- Failed measurements will have to be repeated. A measurement can be considered failed if i) it has not been performed as expected, ii) it has not provided the information necessary to obtain the parameters addressed by the measurement
- Measurements revealing anomalies in the instrument functioning of performances will imply the development of a dedicated contingency plan. This assumes that additional measurement will be needed, and time should be accommodated for this
- Measurements requiring the availability of planets as primary calibrators will not consider a contingency plan making use of asteroids (the time increase they imply is simply prohibitive). This means that in the event of un-availability of such targets, the respective measurements will have to be postponed until the adequate sources are visible again.
- Assumption on telescope thermal stability: TBD

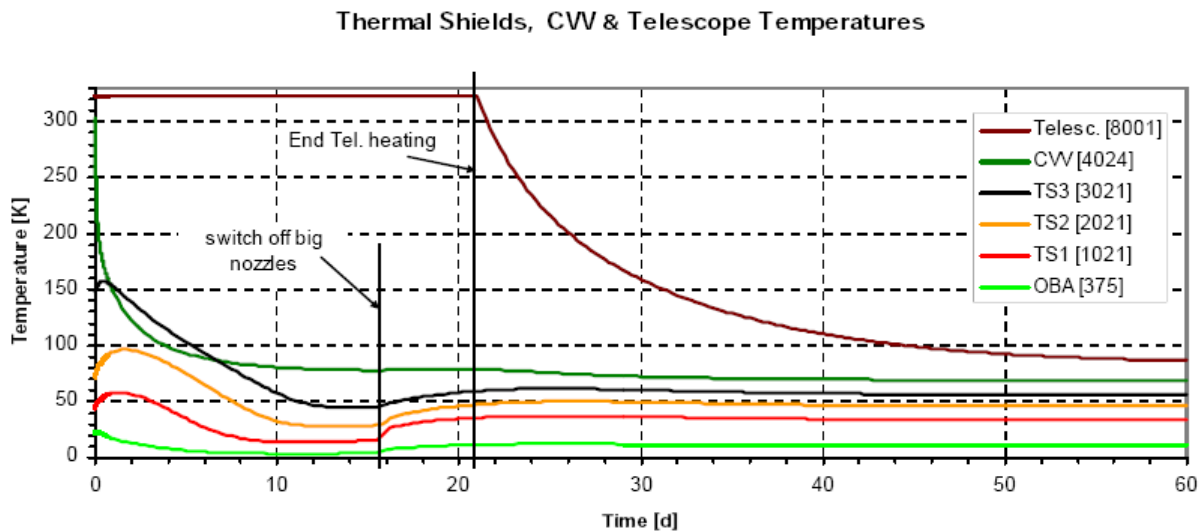


Fig. 1: PLM temperature evolution during in-orbit cool-down, as taken from RD2.

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5 Manning and analysis plan

It is assumed that HIFI ICC personnel will only be present at the MOC during the COP activities involving real-time TM analysis. This naturally applies as well to the instrument switch-on/off and any activity related to OBSW maintenance.

For those activities which only involve an off-line analysis, the ICC personnel will be located at the ICC premises and other sites from the consortium. It is however the plan to have the bulk of the analysis team present at the ICC@ICC. Each COP activity (see section 6) is under the responsibility of a team leader, which is helped by at least 1 person for the analysis, depending on the data volume to be treated and the time-scale.

We assume the following data propagation time from the MOC to the ICC:

- HK TM are at the ICC within 20 min.
- Science TM are at the ICC within 2 hours.

TBFinished

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6 Commissioning Phase Activities

6.1 Overview

The COP for the HIFI instrument can be organized in 6 main phases

- **HIFI-COP-1:** Functional and health checks. This contains the standard health checks performed on the sub-system whenever a new configuration or a shipment has happened.
- **HIFI-COP-2:** Instrument characterisation
- **HIFI-COP-3:** Instrument performance tests with cryo-cover closed
- **HIFI-COP-4:** Instrument performance tests with cryo-cover open. This is the continuation of the performance assessment started previously, but those tests require access to the sky path. This effectively takes place during the PVP time-line
- **HIFI-COP-5:** AOT pre-validation: some of the basic AOTs need validation before entering the FPG and PV-Phase activities. This is the place where this validation takes place.
- **HIFI-COP-6:** Instrument Focal Plane Geometry (FPG).

It is anticipated that most of the activities under phases 1 to 4 above will have been exercised in a reduced manner during the TV/TB campaign. This is particularly true for the interactive analysis steps needed to bring up-to-date the various up-link calibration and configuration files.

Most of the functional tests need to be performed on both the Nominal and Redundant sides of the instrument. The rest of the tests shall be run on the Nominal side, unless specified. In terms of time-line, this means that all Functional tests dedicated to either the Nominal or the Redundant sides should be grouped. Changing sides indeed involves a complete power-off/power-on sequence of the instrument following the flight procedures present at the MOC.

The following table summarizes the overall durations of the above blocks, as well as the total duration of the COP. It already makes some assumptions on the number of time HIFI will have to transition modes (e.g. Off to standby, to primary, back to standby, back to Off if applies – see appendix A). This is indicated in a separate column, and should be seen as a lower limit. It also contains the expected turn-around needed to analyse and feed back to the uplink all necessary information derived from previous measurements. As such it indicates the full time required by HIFI to perform its commissioning.

As can be seen, the total overhead is almost $2/3$ of the total needed time, which indicates that, with an ideal interlacing (and assuming that all 3 instruments need an equal share of the COP

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time), the total time estimated here could be very close to the time needed for the 3 instruments altogether.

Block	Total execution time (h)	Total Analysis and feed-back time (h)	Total needed time (h)	Estimated time for mode transition (h) for 1 OD
HIFI-COP-1	3.4	48	53.8	2.5
HIFI-COP-2	63.8	72 (2.1) + 48 (2.2) + 24 (2.3)	210.75	0.5
HIFI-COP-3	161	72	211	0.5
HIFI-COP-4	75	96	179.6	0.5
HIFI-COP-5	12.3	48	62.8	0.5
HIFI-COP-6	15.5	96	113	0.5
Total (h)	331.0	504	835.0	N.A.

Appendix A presents a tentative time-line, where blocks have been grouped in order to decrease the overheads as much as possible. Typically, blocks applying to either the nominal or the redundant instrument sides have been time-lined together. Similarly, because LO band stabilization is a significant overheads, measurements have been grouped per LO band whenever this would decrease the dead-times. Blocks representing the instrument mode transition have been added on the basis of 21h OD, but they are assumed to be performed during the DTCP, therefore they do not add to the total time. This is also why they are not counted in the table above.

Appendix B compiles the execution time for each sub-block.

The following sections present each of the COP sub-blocks and their timing details.

6.2 Chopper health check: open loop small steps – HIFI-COP-1.1-CPR1

6.2.1 Purpose

This test is the first test of a series of 3 dedicated to check the integrity of the internal chopper mirror (see RD-1). In this procedure, we are checking that the chopper is reacting as expected to small rotations in open loop.

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6.2.2 Pre-conditions

The instrument has been put into Standby-1 mode with either the Nominal or Redundant side, depending upon which one is to be tested here. Assessment of the correct reaction of the chopper depends on the unit in use (see RD-1).

6.2.3 Constraints

This check is a pre-requisite to the execution of step #2 of the chopper health. It shall be performed both for the Nominal and Redundant sides, and has to happen as first activity in the Commissioning plan.

6.2.4 Execution Method

Default: MOIS – MTL is not adequate since the SPACON needs to perform checks interactively

Note that both a MOIS file and the flight procedure written by MOC out of the MOIS are available.

6.2.5 Duration

The time to simply execute all procedures is 1.4 min. This does not take into account the time needed for interaction with the SPACON.

6.2.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK TM only.

6.2.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	H_COP_HIF_NHC1 or HIFI-COP-1.1-CPR1_Nominal.xls	Chopper integrity check #1 with Nominal side	0.7
2	H_COP_HIF_RHC1 or HIFI-COP-1.1-CPR1_Redundant.xls	Chopper integrity check #1 with Redundant side	0.7

6.3 Chopper health check: open loop scans – HIFI-COP-1.1-CPR2

6.3.1 Purpose

This test is the second test of a series of 3 dedicated to check the integrity of the internal chopper mirror (see RD-1). In this procedure, we are checking that the chopper is reacting as expected to scans over its full operating range in open loop.

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6.3.2 Pre-conditions

The procedure HIFI-COP-1.1-CPR1 has been performed with the corresponding instrument side.

The instrument is in Standby-1 mode with either the Nominal or Redundant side, depending upon which one is to be tested here. Assessment of the correct reaction of the chopper depends on the unit in use (see RD-1).

6.3.3 Constraints

This check is a pre-requisite to the execution of step #3 of the chopper health. It shall be performed both for the Nominal and Redundant sides, and has to happen as first activity in the Commissioning plan.

6.3.4 Execution Method

Default: MOIS – MTL is not adequate since the SPACON needs to perform checks interactively

Note that both a MOIS file and the flight procedure written by MOC out of the MOIS are available.

6.3.5 Duration

The time to simply execute all procedures is 8.8 min. This does not take into account the time needed for interaction with the SPACON.

6.3.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK TM only.

6.3.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	H_COP_HIF_NHC2 or HIFI-COP-1.1-CPR2_Nominal.xls	Chopper integrity check #2 with Nominal side	4.4
2	H_COP_HIF_RHC2 or HIFI-COP-1.1-CPR2_Redundant.xls	Chopper integrity check #2 with Redundant side	4.4

6.4 Chopper health check: closed loop health check – HIFI-COP-1.1-CPR3

6.4.1 Purpose

This test is the third test of a series of 3 dedicated to check the integrity of the internal chopper mirror (see RD-1). In this procedure, we are checking that the chopper settings in

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close loop are stable. For this, pre-defined rotations are performed and the corresponding HK values checked against references.

6.4.2 Pre-conditions

The procedure HIFI-COP-1.1-CPR2 has been performed with the corresponding instrument side.

The instrument is in Standby-1 mode with either the Nominal or Redundant side, depending upon which one is to be tested here. Assessment of the correct reaction of the chopper depends on the unit in use (see RD-1).

6.4.3 Constraints

This check is a pre-requisite to the execution of any subsequent procedure in the Commissioning plan that makes use of the chopper in closed loop. It shall be performed both for the Nominal and Redundant sides.

6.4.4 Execution Method

Default: MOIS – MTL is not adequate since the SPACON needs to perform checks interactively

Note that both a MOIS file and the flight procedure written by MOC out of the MOIS are available.

6.4.5 Duration

The time to simply execute all procedures is 1.2 min. This does not take into account the time needed for interaction with the SPACON.

6.4.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK TM only.

6.4.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	H_FCP_HIF_NHC3 or HIFI-COP-1.1-CPR3_Nominal.xls	Chopper integrity check #3 with Nominal side	0.6
2	H_FCP_HIF_RHC3 or HIFI-COP-1.1-CPR3_Redundant.xls	Chopper integrity check #3 with Redundant side	0.6

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6.5 WBS Functional tests – HIFI-COP-1.2-WBS_FT

6.5.1 Purpose

This test is the standard functional test of the WBS spectrometers and it simultaneously addresses the H and V units. It consists of checks of the internal zero, comb and respective attenuators, as well as the linearity of the response. The test will be run on the Nominal side only, and for both lasers (this latter redundancy is embedded inside the procedures).

6.5.2 Pre-conditions

The instrument has been put into Standby-1, Standby-2 or Primary modes with the Nominal side. Note that there is no particular need to switch the lasers prior to the test (i.e. Standby-2 or Primary), although it does not affect the results.

6.5.3 Constraints

This test must be done with no input power fed into the spectrometer. It is thus required to run the procedures before any configuration of the FPU into an active mixer band. This is achieved by having the instrument in Standby.

6.5.4 Execution Method

Default: MOIS – Backup: MTL

6.5.5 Duration

The time to simply execute all procedures is 23 min.

6.5.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM.

6.5.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-1.2-WBS_FT_Nominal.xls	WBS FT with Nominal side	23

6.6 FPU Functional Tests – HIFI-COP-1.2-FPU_FT

6.6.1 Purpose

This is the standard functional test of the FPU. It consists of a simple initialization of each mixer band, as well as a check of the heater for bands 1 to 5 (SIS mixers). It addresses simultaneously the H and V polarizations and it needs to be performed only on the Nominal

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side. The test shall be done for each of the 7 mixer bands, as well as on a fictive band called band 8, which provides the band 3 IF settings, the rest corresponding to the standby stage.

6.6.2 Pre-conditions

The instrument has been put into Standby-1, Standby-2 or Primary modes on the Nominal side.

6.6.3 Constraints

HIFI mixers need to be in He-2 conditions.

6.6.4 Execution Method

Default: MOIS – Backup: MTL

6.6.5 Duration

The time to simply execute all procedures is 15 min.

6.6.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK TM only.

6.6.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-1.2-FPU_FT_B8_Nominal.xls	FPU FT band 8 with Nominal side	2.5
2	HIFI-COP-1.2-FPU_FT_B6_Nominal.xls	FPU FT band 6 with Nominal side	0.15
3	HIFI-COP-1.2-FPU_FT_B7_Nominal.xls	FPU FT band 7 with Nominal side	0.15
4	HIFI-COP-1.2-FPU_FT_B1_Nominal.xls	FPU FT band 1 with Nominal side	2.3
5	HIFI-COP-1.2-FPU_FT_B2_Nominal.xls	FPU FT band 2 with Nominal side	2.4
6	HIFI-COP-1.2-FPU_FT_B3_Nominal.xls	FPU FT band 3 with Nominal side	2.5
7	HIFI-COP-1.2-FPU_FT_B4_Nominal.xls	FPU FT band 4 with Nominal side	2.5
8	HIFI-COP-1.2-FPU_FT_B5_Nominal.xls	FPU FT band 5 with Nominal side	2.5

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6.7 HRS Functional Tests – HIFI-COP-1.2-HRS_FT

6.7.1 Purpose

This test is the standard Functional test for the HRS spectrometers, and it addresses both H and V polarizations simultaneously. The test consists of a series of pre-defined configuration of the auto-correlator, as well as a measurement of the linearity of its response. This test needs to be performed for the Nominal side only.

6.7.2 Pre-conditions

The instrument has been put into Standby-1, Standby-2 or Primary modes with the Nominal side.

6.7.3 Constraints

These tests need that some IF input power be fed into the backend. This will be achieved by leaving the FPU active band as of the last of the FPU FT. Here, we have chosen to use the band 5 for that purpose, this is the reason why the previous test sequence ends in this mixer band.

6.7.4 Execution Method

Default: MOIS – Backup: MTL

6.7.5 Duration

The time to simply execute all procedures is 18 min.

6.7.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM.

6.7.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-1.2-HRS_FT_Nominal.xls	HRS FT with Nominal side	18

6.8 IF chain Functional Tests – HIFI-COP-1.2-IF_FT

6.8.1 Purpose

This test checks the functionality of the IF chain up to the spectrometers. It checks that, once a given FPU band is switched on and IF power is fed to the spectrometer, a signal at the expected level is indeed seen at the backend. It addresses simultaneously the H and V

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polarizations and it needs to be performed only for the Nominal side. The test shall be done for each of the 7 mixer bands.

6.8.2 Pre-conditions

The instrument has been put into Standby-2 or Primary modes on the Nominal side. The WBS lasers will in fact be switched on as part of the procedures.

6.8.3 Constraints

HIFI mixers need to be in He-2 conditions.

6.8.4 Execution Method

Default: MOIS – Backup: MTL

6.8.5 Duration

The time to simply execute all procedures is 3.5 min.

6.8.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK TM only.

6.8.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-1.2-IF_FT_B1_Nominal.xls	IF FT band 1 with Nominal side	0.5
2	HIFI-COP-1.2-IF_FT_B2_Nominal.xls	IF FT band 2 with Nominal side	0.5
3	HIFI-COP-1.2-IF_FT_B3_Nominal.xls	IF FT band 3 with Nominal side	0.5
4	HIFI-COP-1.2-IF_FT_B4_Nominal.xls	IF FT band 4 with Nominal side	0.5
5	HIFI-COP-1.2-IF_FT_B5_Nominal.xls	IF FT band 5 with Nominal side	0.5
6	HIFI-COP-1.2-IF_FT_B6_Nominal.xls	IF FT band 6 with Nominal side	0.5
7	HIFI-COP-1.2-IF_FT_B7_Nominal.xls	IF FT band 7 with Nominal side	0.5

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6.9 Local Oscillator Functional Tests – HIFI-COP-1.2-LO_FT

6.9.1 Purpose

This test is the standard functional test of the Local Oscillator Unit. It consists of a switch of each of the LO-band at the default frequencies and safe voltages, as well as an IV Curve characterization of the multipliers. This test shall be done for each of the 14 LO sub-bands.

6.9.2 Pre-conditions

The instrument has been put into Primary mode with either the Nominal or Redundant side, depending upon which one is to be tested here. Note that these procedures will fail if the instrument is in Standby mode.

6.9.3 Constraints

The LCU safety table and patch upload must have been successfully uploaded prior to the execution of this test.

6.9.4 Execution Method

Default: MOIS – Backup: MTL

6.9.5 Duration

The time to simply execute all procedures is 2.6 h.

6.9.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK TM only.

6.9.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-1.2-LO_FT_B1a_Nominal.xls	LO FT band 1a with Nominal side	5
2	HIFI-COP-1.2-LO_FT_B1b_Nominal.xls	LO FT band 1b with Nominal side	5
	HIFI-COP-1.2-LO_FT_B2a_Nominal.xls	LO FT band 2a with Nominal side	6.5
	HIFI-COP-1.2-LO_FT_B2b_Nominal.xls	LO FT band 2b with Nominal side	6.5
	HIFI-COP-1.2-	LO FT band 3a with	6.5

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	LO_FT_B3a_Nominal.xls	Nominal side	
	HIFI-COP-1.2- LO_FT_B3b_Nominal.xls	LO FT band 3b with Nominal side	6.7
	HIFI-COP-1.2- LO_FT_B4a_Nominal.xls	LO FT band 4a with Nominal side	5
	HIFI-COP-1.2- LO_FT_B4b_Nominal.xls	LO FT band 4b with Nominal side	5
	HIFI-COP-1.2- LO_FT_B5a_Nominal.xls	LO FT band 5a with Nominal side	5
	HIFI-COP-1.2- LO_FT_B5b_Nominal.xls	LO FT band 5b with Nominal side	5
	HIFI-COP-1.2- LO_FT_B6a_Nominal.xls	LO FT band 6a with Nominal side	6.5
	HIFI-COP-1.2- LO_FT_B6b_Nominal.xls	LO FT band 6b with Nominal side	5.25
	HIFI-COP-1.2- LO_FT_B7a_Nominal.xls	LO FT band 7a with Nominal side	5.25
	HIFI-COP-1.2- LO_FT_B7b_Nominal.xls	LO FT band 7b with Nominal side	5.25
	HIFI-COP-1.2- LO_FT_B1a_Redundant.xls	LO FT band 1a with Redundant side	5
	HIFI-COP-1.2- LO_FT_B1b_Redundant.xls	LO FT band 1b with Redundant side	5
	HIFI-COP-1.2- LO_FT_B2a_Redundant.xls	LO FT band 2a with Redundant side	6.5
	HIFI-COP-1.2- LO_FT_B2b_Redundant.xls	LO FT band 2b with Redundant side	6.5
	HIFI-COP-1.2- LO_FT_B3a_Redundant.xls	LO FT band 3a with Redundant side	6.5
	HIFI-COP-1.2- LO_FT_B3b_Redundant.xls	LO FT band 3b with Redundant side	6.7
	HIFI-COP-1.2- LO_FT_B4a_Redundant.xls	LO FT band 4a with Redundant side	5
	HIFI-COP-1.2- LO_FT_B4b_Redundant.xls	LO FT band 4b with Redundant side	5
	HIFI-COP-1.2- LO_FT_B5a_Redundant.xls	LO FT band 5a with Redundant side	5
	HIFI-COP-1.2- LO_FT_B5b_Redundant.xls	LO FT band 5b with Redundant side	5
	HIFI-COP-1.2- LO_FT_B6a_Redundant.xls	LO FT band 6a with Redundant side	6.5
	HIFI-COP-1.2- LO_FT_B6b_Redundant.xls	LO FT band 6b with Redundant side	5.25
	HIFI-COP-1.2- LO_FT_B7a_Redundant.xls	LO FT band 7a with Redundant side	5.25

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	LO_FT_B7a_Redundant.xls	Redundant side	
	HIFI-COP-1.2- LO_FT_B7b_Redundant.xls	LO FT band 7b with Redundant side	5.25

6.10 Chopper Response Time – HIFI-COP-1.2-CPR-RespTime

6.10.1 Purpose

This test is dedicated to the chopper response time to move from one angle to another. The outcome of this test is fed into the uplink LUT in order to indicate the dead-time needed to achieve the rotation between e.g. two positions on the sky. The response is independent of the band as the actuators are shared between all bands.

6.10.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Success of HIFI-COP-1.1 is a requirement. In particular, use of the chopper in closed must have been secured at that stage.

6.10.3 Constraints

None

6.10.4 Execution Method

Default: MOIS procedures – Backup: MTL

6.10.5 Duration

The time to simply execute all procedures is 1.5 min.

6.10.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK TM only.

6.10.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-2.1-CPR-RespTime_Nominal.xls	Chopper response time with Nominal side	0.8
2	HIFI-COP-2.1-CPR-RespTime_Redundantl.xls	Chopper response time with Redundant side	0.8

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6.11 Initial Diplexer Calibration: fast scans – HIFI-COP-2.1-DipCal1

6.11.1 Purpose

This test is dedicated to the calibration of the diplexers in use in bands 3, 4, 6 and 7 to couple the LO beam and the sky beams onto the mixer feed. It consists of a collection of measurements at key frequencies over the operating range of a given mixer. The analysis of these measurements will feed a dedicated model allowing to derive the LUT to be updated in the uplink database.

6.11.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Success of HIFI-COP-1 is a requirement.

6.11.3 Constraints

None.

6.11.4 Execution Method

Default: MTL – Backup: MOIS procedures

6.11.5 Duration

The time to simply execute all procedures is 5.7 h.

6.11.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK TM only.

6.11.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-2.1-DipCal1_B3.xls	Fast Diplexer calibration band 3	78
2	HIFI-COP-2.1-DipCal1_B3.xls	Fast Diplexer calibration band 4	57
3	HIFI-COP-2.1-DipCal1_B3.xls	Fast Diplexer calibration band 6	99
4	HIFI-COP-2.1-DipCal1_B3.xls	Fast Diplexer calibration	110

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		band 7	
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6.12 Functional Tests Un-Pumped – HIFI-COP-2.1-FTUnp

6.12.1 Purpose

This test is dedicated to the system response in absence of LO power, i.e. with the mixer un-pumped. As such it is a measurement of the full IF chain properties. The test shall be done for each of the 7 mixer bands.

6.12.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Success of HIFI-COP-1 is a requirement.

6.12.3 Constraints

None

6.12.4 Execution Method

Default: MTL – Backup: MOIS procedures

6.12.5 Duration

The time to simply execute all procedures is 25 min.

6.12.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM.

6.12.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-2.1-FTUnp_B1.xls	FT un-pumped band 1	4.4
2	HIFI-COP-2.1-FTUnp_B2.xls	FT un-pumped band 2	4.5
3	HIFI-COP-2.1-FTUnp_B3.xls	FT un-pumped band 3	4.6
4	HIFI-COP-2.1-FTUnp_B4.xls	FT un-pumped band 4	4.6
5	HIFI-COP-2.1-FTUnp_B5.xls	FT un-pumped band 5	4.6
6	HIFI-COP-2.1-FTUnp_B6.xls	FT un-pumped band 6	1.1
7	HIFI-COP-2.1-FTUnp_B7.xls	FT un-pumped band 7	1.1

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6.13 IF Feed-back tests with cryo-cover closed – HIFI-COP-2.1-IF-FBk1

6.13.1 Purpose

This test is dedicated to study the effect of IF feedback in the detection chain when the focal plane chopper is used at different angle. Long integrations towards various pairs of chopper angles will be performed. This test shall be done for each of the 7 mixer bands.

6.13.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. The cryo-cover shall be closed. Success of HIFI-COP-1 is a requirement. In particular, use of the chopper in closed must have been secured at that stage. Successful completion of HIFI-COP-2.1-FTUnp is preferable, although it is not mandatory in order to proceed with the present test.

6.13.3 Constraints

None.

6.13.4 Execution Method

Default: MTL – Backup: MOIS procedures

6.13.5 Duration

The time to simply execute all procedures is 11.8 h.

6.13.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM.

6.13.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-2.1-IF-FBk1_B1.xls	IF feed-back in band 1	101
2	HIFI-COP-2.1-IF-FBk1_B2.xls	IF feed-back in band 2	101
3	HIFI-COP-2.1-IF-FBk1_B3.xls	IF feed-back in band 3	101
4	HIFI-COP-2.1-IF-FBk1_B4.xls	IF feed-back in band 4	101
5	HIFI-COP-2.1-IF-FBk1_B5.xls	IF feed-back in band 5	101
6	HIFI-COP-2.1-IF-FBk1_B6.xls	IF feed-back in band 6	101
7	HIFI-COP-2.1-IF-FBk1_B7.xls	IF feed-back in band 7	101

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6.14 IF Stability Measurements – HIFI-COP-2.1-Stab-IF

6.14.1 Purpose

This test is dedicated to the measurement of the stability of the system in absence of LO power. This indicates the stability of the full IF chain. The stability is assessed via the so-called Allan variance, which is derived from long integrations. The test shall be done for each of the 7 mixer bands.

6.14.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Success of HIFI-COP-1 is a requirement. Successful completion of HIFI-COP-2.1-FTUnp is necessary, especially in the perspective of the LUT update potentially needed on the IF settings.

6.14.3 Constraints

None

6.14.4 Execution Method

Default: MTL – Backup: MOIS procedures

6.14.5 Duration

The time to simply execute all procedures is 6h.

6.14.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM.

6.14.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-2.1-Stab-IF_B1.xls	IF stability in band 1	51
2	HIFI-COP-2.1-Stab-IF_B2.xls	IF stability in band 2	51
3	HIFI-COP-2.1-Stab-IF_B3.xls	IF stability in band 3	51
4	HIFI-COP-2.1-Stab-IF_B4.xls	IF stability in band 4	51
5	HIFI-COP-2.1-Stab-IF_B5.xls	IF stability in band 5	51
6	HIFI-COP-2.1-Stab-IF_B6.xls	IF stability in band 6	51
7	HIFI-COP-2.1-Stab-IF_B7.xls	IF stability in band 7	51

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6.15 Second Diplexer calibration: hot-cold scans – HIFI-COP-2.2-DipCal2

6.15.1 Purpose

This test is the stage of the diplexer calibration. Based on the first measurements (HIFI-COP-2.1-DipCal1) a diplexer position model dependent on the LO frequency has been built. This test allows to refine the model based on an optimisation of the sensitivity.

6.15.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Success of HIFI-COP-1 is a requirement. In particular, use of the chopper in closed must have been secured at that stage. Moreover, since this test is a refinement of HIFI-COP-2.1-DipCal1, this latter must have been completed successfully and its results must have been implemented in the uplink database.

6.15.3 Constraints

The internal hot calibrator source heater has to be on (i.e. Standby-2 or Primary) for more than 10h.

6.15.4 Execution Method

Default: MTL – Backup: MOIS procedures

6.15.5 Duration

The time to simply execute all procedures is 3.1h.

6.15.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM, although the bulk of the analysis can be performed with HK TM only (Science TM provide a redundant diagnostic information)

6.15.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-2.2-DipCal2_B3.xls	Hot-cold Diplexer calibration band 3	44
2	HIFI-COP-2.2-DipCal2_B4.xls	Hot-cold Diplexer calibration band 4	32
3	HIFI-COP-2.2-DipCal2_B6.xls	Hot-cold Diplexer calibration band 6	51
4	HIFI-COP-2.2-DipCal2_B7.xls	Hot-cold Diplexer calibration band 7	57

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6.16 LO power calibration: vector scans – HIFI-COP-2.2-VecscanCal

6.16.1 Purpose

This test is dedicated to a fine sampled characterisation of the LO pumping level needs over the full HIFI frequency range. Each of the 14 LO sub-band will be fully surveyed at a fixed frequency grid, with potential refinement in areas of interest (e.g. band edges or around power gaps). The outcome of this test is one of the fundamental LUT which allows the automatic LO power levelling to pump the mixer at whatever requested frequency.

6.16.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Success of HIFI-COP-1 is a prerequisite, with particular emphasis on the HIFI-COP-1.2-LO_FT. Updates of the diplexer model following HIFI-2.2-DipCal2 is also required.

6.16.3 Constraints

None.

6.16.4 Execution Method

Default: MTL – Backup: MOIS procedures

6.16.5 Duration

The time to simply execute all procedures is 29h.

6.16.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK TM only.

6.16.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-2.2-VecscanCal_B1a.xls	Vector Scan calibration 1a	87
2	HIFI-COP-2.2-VecscanCal_B1b.xls	Vector Scan calibration 1b	87
3	HIFI-COP-2.2-VecscanCal_B2a.xls	Vector Scan calibration 2a	114
4	HIFI-COP-2.2-VecscanCal_B2b.xls	Vector Scan calibration 2b	94
5	HIFI-COP-2.2-VecscanCal_B3a.xls	Vector Scan calibration 3a	60
6	HIFI-COP-2.2-VecscanCal_B3b.xls	Vector Scan calibration 3b	113
7	HIFI-COP-2.2-VecscanCal_B4a.xls	Vector Scan calibration 4a	80
8	HIFI-COP-2.2-VecscanCal_B4b.xls	Vector Scan calibration 4b	78
9	HIFI-COP-2.2-VecscanCal_B5a.xls	Vector Scan calibration 5a	162

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10	HIFI-COP-2.2-VecscanCal_B5b.xls	Vector Scan calibration 5b	162
11	HIFI-COP-2.2-VecscanCal_B6a.xls	Vector Scan calibration 6a	194
12	HIFI-COP-2.2-VecscanCal_B6b.xls	Vector Scan calibration 6b	172
13	HIFI-COP-2.2-VecscanCal_B7a.xls	Vector Scan calibration 7a	195
14	HIFI-COP-2.2-VecscanCal_B7b.xls	Vector Scan calibration 7b	245

6.17 Chopper scan with IF power over the internal loads – HIFI-COP-2.3-CPR-Scan1

6.17.1 Purpose

This test is dedicated to the calibration of the chopper positions towards the two (hot and cold) internal calibration loads. For each of the 7 mixer bands, and for 3 frequencies for each (edges and middle), the chopper is scanned over the calibration source assembly (CSA) area and total power spectra are taken, in order to monitor the input power at each angular position. Typically, the power towards the hot calibration source (100K versus 15K in the sink) appears as a peak.

6.17.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Success of HIFI-COP-1 is a requirement. In particular, use of the chopper in closed must have been secured at that stage. Outcomes of HIFI-COP-2.2-VecscanCal must have been propagated into the database, as well as the most up-to-date diplexer model (HIFI-COP-2.2-DipCal2).

6.17.3 Constraints

The internal hot calibrator source heater has to be on (i.e. Standby-2 or Primary) for more than 10h.

6.17.4 Execution Method

Default: MTL – Backup: MOIS procedures

6.17.5 Duration

The time to simply execute all procedures is 7.8h

6.17.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM.

6.17.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-2.3-CPR-Scan1_B1.xls	Chopper sky on CSA path	67

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		band 1	
2	HIFI-COP-2.3-CPR-Scan1_B2.xls	Chopper sky on CSA path band 2	67
3	HIFI-COP-2.3-CPR-Scan1_B3.xls	Chopper sky on CSA path band 3	67
4	HIFI-COP-2.3-CPR-Scan1_B4.xls	Chopper sky on CSA path band 4	67
5	HIFI-COP-2.3-CPR-Scan1_B5.xls	Chopper sky on CSA path band 5	67
6	HIFI-COP-2.3-CPR-Scan1_B6.xls	Chopper sky on CSA path band 6	67
7	HIFI-COP-2.3-CPR-Scan1_B7.xls	Chopper sky on CSA path band 7	67

6.18 Heater deflux characterisation – HIFI-COP-3-Deflux

6.18.1 Purpose

This test is dedicated to the characterisation of the instrument sensitivity to magnetic field trapping in the magnets associated to each of the SIS mixers. This trapped flux has an influence on the settings to which the mixer should be set for optimum sensitivity. In order to release the trapped flux, heaters are activated for a couple of second, then a relaxation time is waited for thermal stabilization of the 2K level. Because the heater in band 5 is not strong enough, we will not consider this test for this band. In all other SIS bands (1 to 4) a test block will be executed, which measures the optimum magnet settings before and after a deflux. Time scale between two of these tests is important as flux trapping is more or less significant depending on e.g. actions or not of the reaction wheels, etc.

6.18.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Success of HIFI-COP-2 is a requirement. In particular, HIFI should be able to pump its mixer in an optimum way.

6.18.3 Constraints

The test block will be considered in two circumstances:

- It will be systematically run at the beginning of each COP OD. This provides statistics on 24h time bins
- On two particular circumstances during the COP/PVP, a finer sampling will be needed. Typically we need to deflux every 2h during 2 ODs, and for so-called quiescent and noisy periods in terms of flux trapping. While the first one can be perform during e.g. the Tsys survey and/or stability measurement, the second requires sustained use of the reaction wheels, therefore being more adequately programmed during PVP (e.g. FPG).

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6.18.4 Execution Method

Default: MTL – Backup: MOIS procedures

6.18.5 Duration

The time to execute one single block is 21min. This will be applied at the beginning of each OD. On top of that the dedicated fine granularity tests will add 2x 6.7h = 13.4h

6.18.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK TM only.

6.18.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-3-Deflux.xls	Heater deflux bands 1 to 4	20

6.19 Functional Tests pumped – HIFI-COP-3-FTP

6.19.1 Purpose

This test is dedicated to the characterisation of the instrument response over the full detection chain, i.e. with a pumped mixer. This test shall be performed for each of the LO sub-band and collects simultaneous data for the H and V polarizations. For each sub-band, 5 pre-defined key frequencies are considered, where the sensitivity and IV curves are measured.

6.19.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Success of HIFI-COP-1 is a requirement. In particular, use of the chopper in closed must have been secured at that stage. Outcomes of HIFI-COP-2.2-VecscanCal must have been propagated into the database, as well as the most up-to-date diplexer model (HIFI-COP-2.2-DipCal2).

6.19.3 Constraints

The internal hot calibrator source heater has to be on (i.e. Standby-2 or Primary) for more than 10h.

6.19.4 Execution Method

Default: MTL – Backup: MOIS procedures

6.19.5 Duration

The time to simply execute all procedures is 7.2h

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6.19.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM.

6.19.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-3-FTP_B1a.xls	FT Pumped for band 1a	42
2	HIFI-COP-3-FTP_B1b.xls	FT Pumped for band 1b	42
3	HIFI-COP-3-FTP_B2a.xls	FT Pumped for band 2a	42
4	HIFI-COP-3-FTP_B2b.xls	FT Pumped for band 2b	42
5	HIFI-COP-3-FTP_B3a.xls	FT Pumped for band 3a	43
6	HIFI-COP-3-FTP_B3b.xls	FT Pumped for band 3b	43
7	HIFI-COP-3-FTP_B4a.xls	FT Pumped for band 4a	43
8	HIFI-COP-3-FTP_B4b.xls	FT Pumped for band 4b	43
9	HIFI-COP-3-FTP_B5a.xls	FT Pumped for band 5a	45
10	HIFI-COP-3-FTP_B5b.xls	FT Pumped for band 5b	45
11	HIFI-COP-3-FTP_B6a.xls	FT Pumped for band 6a	24
12	HIFI-COP-3-FTP_B6b.xls	FT Pumped for band 6b	24
13	HIFI-COP-3-FTP_B7a.xls	FT Pumped for band 7a	24
14	HIFI-COP-3-FTP_B7b.xls	FT Pumped for band 7b	24

6.20 Standing Wave tests against CSA – HIFI-COP-3-StWv1

6.20.1 Purpose

This test is dedicated to the characterisation of the potential standing waves arising in the HIFI FPU, especially towards internal calibrator loads, and on the mixer-to-LOU optical path. For each LO sub-band, mini frequency surveys (frequency sampling of 27 MHz) of size between some tens of MHz up to ~1 GHz will be performed at 5 pre-defined key frequencies.

6.20.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Success of HIFI-COP-1 is a requirement. In particular, use of the chopper in closed must have been secured at that stage. Outcomes of HIFI-COP-2.2-VecscanCal must have been propagated into the database, as well as the most up-to-date diplexer model (HIFI-COP-2.2-DipCal2).

6.20.3 Constraints

The internal hot calibrator source heater has to be on (i.e. Standby-2 or Primary) for more than 10h.

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6.20.4 Execution Method

Default: MTL – Backup: MOIS procedures

6.20.5 Duration

The time to simply execute all procedures is 10h

6.20.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM.

6.20.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-3-StWv1_B1a.xls	Standing wave against CSA for band 1a	48
2	HIFI-COP-3-StWv1_B1b.xls	Standing wave against CSA for band 1b	48
3	HIFI-COP-3-StWv1_B2a.xls	Standing wave against CSA for band 2a	28
4	HIFI-COP-3-StWv1_B2b.xls	Standing wave against CSA for band 2b	28
5	HIFI-COP-3-StWv1_B3a.xls	Standing wave against CSA for band 3a	28
6	HIFI-COP-3-StWv1_B3b.xls	Standing wave against CSA for band 3b	28
7	HIFI-COP-3-StWv1_B4a.xls	Standing wave against CSA for band 4a	48
8	HIFI-COP-3-StWv1_B4b.xls	Standing wave against CSA for band 4b	48
9	HIFI-COP-3-StWv1_B5a.xls	Standing wave against CSA for band 5a	29
10	HIFI-COP-3-StWv1_B5b.xls	Standing wave against CSA for band 5b	28
11	HIFI-COP-3-StWv1_B6a.xls	Standing wave against CSA for band 6a	28
12	HIFI-COP-3-StWv1_B6b.xls	Standing wave against CSA for band 6b	28
13	HIFI-COP-3-StWv1_B7a.xls	Standing wave against CSA for band 7a	48
14	HIFI-COP-3-StWv1_B7b.xls	Standing wave against CSA for band 7b	48

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6.21 Noise Temperature Survey – HIFI-COP-3-Tsys

6.21.1 Purpose

This test performs a fine-sampling survey of the HIFI sensitivity over the full tuneable range, by means of the system noise temperature derived from integrations towards the 2 internal calibration loads. Each of the 14 LO sub-band will be fully surveyed at a fixed frequency grid, with potential refinement in areas of interest (e.g. band edges or around power gaps). Simultaneous data will be collected for the H and V polarizations.

6.21.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Success of HIFI-COP-1 is a requirement. In particular, use of the chopper in closed must have been secured at that stage. Outcomes of HIFI-COP-2.2-VecscanCal must have been propagated into the database, as well as the most up-to-date diplexer model (HIFI-COP-2.2-DipCal2).

6.21.3 Constraints

The internal hot calibrator source heater has to be on (i.e. Standby-2 or Primary) for more than 10h.

6.21.4 Execution Method

Default: MTL – Backup: MOIS procedures

6.21.5 Duration

The time to simply execute all procedures is 21.7h

6.21.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM.

6.21.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-3-Tsys_B1a.xls	Tsys measurement band 1a	65
2	HIFI-COP-3-Tsys_B1b.xls	Tsys measurement band 1b	65
3	HIFI-COP-3-Tsys_B2a.xls	Tsys measurement band 2a	85
4	HIFI-COP-3-Tsys_B2b.xls	Tsys measurement band 2b	71
5	HIFI-COP-3-Tsys_B3a.xls	Tsys measurement band 3a	45
6	HIFI-COP-3-Tsys_B3b.xls	Tsys measurement band 3b	83
7	HIFI-COP-3-Tsys_B4a.xls	Tsys measurement band 4a	92
8	HIFI-COP-3-Tsys_B4b.xls	Tsys measurement band 4b	58

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9	HIFI-COP-3-Tsys_B5a.xls	Tsys measurement band 5a	125
10	HIFI-COP-3-Tsys_B5b.xls	Tsys measurement band 5b	125
11	HIFI-COP-3-Tsys_B6a.xls	Tsys measurement band 6a	112
12	HIFI-COP-3-Tsys_B6b.xls	Tsys measurement band 6b	99
13	HIFI-COP-3-Tsys_B7a.xls	Tsys measurement band 7a	112
14	HIFI-COP-3-Tsys_B7b.xls	Tsys measurement band 7b	140

6.22 Stability Measurements: internal reference modes – HIFI-COP-3-Stab-1

6.22.1 Purpose

This test is to the measurement of the stability of the full HIFI detection chain in a series of representative modes of data acquisition. The modes considered here focus on the internal reference modes, i.e. they do not require to look at the sky. The stability will be derived from the so-called Allan variance, which is obtained from long time series of the spectrometer output. For each LO sub-band, a collection of pre-defined key frequencies will be surveyed, the number of which will depend on the data acquisition mode considered.

The stability measurements considered for each band are:

- A Stabilization monitoring measurement at the first frequency of the list
- At 4-8 frequencies, a System stability measurement, which is started with a short fast sampling integration with the HRS only for HEB bands
- At 2 frequencies, a internal load stability measurement
- At 2 frequencies, and 2-3 frequency throw per frequency, a frequency switch stability measurement

6.22.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Success of HIFI-COP-2 is a requirement. Outcomes of HIFI-COP-2.2-VecscanCal must have been propagated into the database, as well as the most up-to-date diplexer model (HIFI-COP-2.2-DipCal2).

6.22.3 Constraints

The internal hot calibrator source heater has to be on (i.e. Standby-2 or Primary) for more than 10h.

6.22.4 Execution Method

Default: MTL – Backup: MOIS procedures

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6.22.5 Duration

The time to simply execute all procedures is 99h

6.22.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM.

6.22.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-3-Stab-1_B1a_stab	Stabilization of band 1a	22
2	HIFI-COP-3-Stab-1_B1a_sys	System stability band 1a	119
3	HIFI-COP-3-Stab-1_B1a_int	Int. load stability band 1a	124
4	HIFI-COP-3-Stab-1_B1a_fsw	FSW stability band 1a	130
5	HIFI-COP-3-Stab-1_B1b_stab	Stabilization of band 1b	22
6	HIFI-COP-3-Stab-1_B1b_sys	System stability band 1b	97
7	HIFI-COP-3-Stab-1_B1b_int	Int. load stability band 1b	124
8	HIFI-COP-3-Stab-1_B1b_fsw	FSW stability band 1b	130
9	HIFI-COP-3-Stab-1_B2a_stab	Stabilization of band 2a	22
10	HIFI-COP-3-Stab-1_B2a_sys	System stability band 2a	119
11	HIFI-COP-3-Stab-1_B2a_int	Int. load stability band 2a	124
12	HIFI-COP-3-Stab-1_B2a_fsw	FSW stability band 2a	131
13	HIFI-COP-3-Stab-1_B2b_stab	Stabilization of band 2b	22
14	HIFI-COP-3-Stab-1_B2b_sys	System stability band 2b	140
15	HIFI-COP-3-Stab-1_B2b_int	Int. load stability band 2b	134
16	HIFI-COP-3-Stab-1_B2b_fsw	FSW stability band 2b	130
17	HIFI-COP-3-Stab-1_B3a_stab	Stabilization of band 3a	22
18	HIFI-COP-3-Stab-1_B3a_sys	System stability band 3a	97
19	HIFI-COP-3-Stab-1_B3a_int	Int. load stability band 3a	124
20	HIFI-COP-3-Stab-1_B3a_fsw	FSW stability band 3a	194
21	HIFI-COP-3-Stab-1_B3b_stab	Stabilization of band 3b	22
22	HIFI-COP-3-Stab-1_B3b_sys	System stability band 3b	119
23	HIFI-COP-3-Stab-1_B3b_int	Int. load stability band 3b	124
24	HIFI-COP-3-Stab-1_B3b_fsw	FSW stability band 3b	194
25	HIFI-COP-3-Stab-1_B4a_stab	Stabilization of band 4a	22
26	HIFI-COP-3-Stab-1_B4a_sys	System stability band 4a	178
27	HIFI-COP-3-Stab-1_B4a_int	Int. load stability band 4a	124
28	HIFI-COP-3-Stab-1_B4a_fsw	FSW stability band 4a	194
29	HIFI-COP-3-Stab-1_B4b_stab	Stabilization of band 4b	22
30	HIFI-COP-3-Stab-1_B4b_sys	System stability band 4b	119
31	HIFI-COP-3-Stab-1_B4b_int	Int. load stability band 4b	124

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32	HIFI-COP-3-Stab-1_B4b_fsw	FSW stability band 4b	194
33	HIFI-COP-3-Stab-1_B5a_stab	Stabilization of band 5a	22
34	HIFI-COP-3-Stab-1_B5a_sys	System stability band 5a	97
35	HIFI-COP-3-Stab-1_B5a_int	Int. load stability band 5a	124
36	HIFI-COP-3-Stab-1_B5a_fsw	FSW stability band 5a	130
37	HIFI-COP-3-Stab-1_B5b_stab	Stabilization of band 5b	22
38	HIFI-COP-3-Stab-1_B5b_sys	System stability band 5b	76
39	HIFI-COP-3-Stab-1_B5b_int	Int. load stability band 5b	124
40	HIFI-COP-3-Stab-1_B5b_fsw	FSW stability band 5b	130
41	HIFI-COP-3-Stab-1_B6a_stab	Stabilization of band 6a	22
42	HIFI-COP-3-Stab-1_B6a_sys	System stability band 6a	119
43	HIFI-COP-3-Stab-1_B6a_int	Int. load stability band 6a	124
44	HIFI-COP-3-Stab-1_B6a_fsw	FSW stability band 6a	130
45	HIFI-COP-3-Stab-1_B6b_stab	Stabilization of band 6b	22
46	HIFI-COP-3-Stab-1_B6b_sys	System stability band 6b	180
47	HIFI-COP-3-Stab-1_B6b_int	Int. load stability band 6b	124
48	HIFI-COP-3-Stab-1_B6b_fsw	FSW stability band 6b	130
49	HIFI-COP-3-Stab-1_B7a_stab	Stabilization of band 7a	22
50	HIFI-COP-3-Stab-1_B7a_sys	System stability band 7a	155
51	HIFI-COP-3-Stab-1_B7a_int	Int. load stability band 7a	134
52	HIFI-COP-3-Stab-1_B7a_fsw	FSW stability band 7a	130
53	HIFI-COP-3-Stab-1_B7b_stab	Stabilization of band 7b	22
54	HIFI-COP-3-Stab-1_B7b_sys	System stability band 7b	140
55	HIFI-COP-3-Stab-1_B7b_int	Int. load stability band 7b	124
56	HIFI-COP-3-Stab-1_B7b_fsw	FSW stability band 7b	130

6.23 Dedicated Spurious Analysis in bands 3b and 7b – HIFI-COP-3-Spur

6.23.1 Purpose

This test addresses the issue of the LO spectral purity in some areas of the tuneable range of the LO sub-bands 3b and 7b. Investigation performed during the ILT have shown that some of the LOU parameter settings chosen in some areas for these sub-bands would not provide the desired level of LO spectral purity. Scanning over a wider possible range for some of these parameters allows to pin-point the optimal settings.

In practice the test consists in performing diplexer scans with the multiplier M1 of each of the LOU varied over a given allowed range.

6.23.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Success of HIFI-COP-2 is a pre-requisite, with particular emphasis on the updates of the diplexer model following HIFI-2.2-DipCal2.

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6.23.3 Constraints

This test must be witnessed by instrument experts since the values taken by the parameter varied here are critical for the health of the LO S/S.

6.23.4 Execution Method

Default: MTL – Backup: MOIS procedures

6.23.5 Duration

The time to simply execute all procedures is 8.6h

6.23.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK TM only.

6.23.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-3-Spur_B3b.xls	LO purity investigation band 3b	194
2	HIFI-COP-3-Spur_B7b.xls	LO purity investigation band 7b	321

6.24 IF Feed-back test with cryo-cover open – HIFI-COP-4-IF-FBk2

6.24.1 Purpose

This test is a repetition of HIFI-COP-2.1-IF-FBk1, this time performed with the cryo-cover open to investigate possible influence of the latter on the level of IF feedback.

6.24.2 Pre-conditions

Same as for HIFI-COP-2.1-IF-FBk1.

6.24.3 Constraints

Cryo-cover **must** be open.

6.24.4 Execution Method

Default: MTL – Backup: MOIS procedures

6.24.5 Duration

The time to simply execute all procedures is 11.8h

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6.24.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM.

6.24.7 Procedure Sequence

Because the only difference with HIFI-COP-2.1-IF-FBk1 is the opening of the cryo-cover, in practice the same procedures can be used.

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-2.1-IF-FBk1_B1.xls	IF feed-back with cryo-cover open in band 1	101
2	HIFI-COP-2.1-IF-FBk1_B2.xls	IF feed-back with cryo-cover open in band 2	101
3	HIFI-COP-2.1-IF-FBk1_B3.xls	IF feed-back with cryo-cover open in band 3	101
4	HIFI-COP-2.1-IF-FBk1_B4.xls	IF feed-back with cryo-cover open in band 4	101
5	HIFI-COP-2.1-IF-FBk1_B5.xls	IF feed-back with cryo-cover open in band 5	101
6	HIFI-COP-2.1-IF-FBk1_B6.xls	IF feed-back with cryo-cover open in band 6	101
7	HIFI-COP-2.1-IF-FBk1_B7.xls	IF feed-back with cryo-cover open in band 7	101

6.25 Stability Measurements: external reference modes – HIFI-COP-4-Stab-2

6.25.1 Purpose

This test is to the measurement of the stability of the full HIFI detection chain in a series of representative modes of data acquisition. The modes considered here focus on the external reference modes, i.e. they do require to stare at the sky. The stability will be derived from the so-called Allan variance, which is obtained from long time series of the spectrometer output. For each LO sub-band, a collection of pre-defined key frequencies will be surveyed, the number of which will depend on the data acquisition mode considered.

The stability measurements considered for each band are:

- A Stabilization monitoring measurement at the first frequency of the list
- At 2 frequencies, a DBS stability measurement
- At 2 frequencies, a Load-Chop stability measurement

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6.25.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Success of HIFI-COP-2 is a requirement. Outcomes of HIFI-COP-2.2-VecscanCal must have been propagated into the database, as well as the most up-to-date diplexer model (HIFI-COP-2.2-DipCal2).

6.25.3 Constraints

Cryo-cover **must** be open.

6.25.4 Execution Method

Default: MTL – Backup: MOIS procedures

6.25.5 Duration

The time to simply execute all procedures is 63h

6.25.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM.

6.25.7 Procedure Sequence

The stabilization of the band is not proper to the context of this test (i.e. cryo-cover open). The same procedures as for HIFI-COP-3-Stab-1 can be used.

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-3-Stab-1_B1a_stab	Stabilization of band 1a	22
2	HIFI-COP-4-Stab-2_B1a_dbs	DBS stability band 1a	124
3	HIFI-COP-4-Stab-2_B1a_lsw	Load-chop stability band 1a	124
4	HIFI-COP-3-Stab-1_B1b_stab	Stabilization of band 1b	22
5	HIFI-COP-4-Stab-2_B1b_dbs	DBS stability band 1b	124
6	HIFI-COP-4-Stab-2_B1b_lsw	Load-chop stability band 1b	124
7	HIFI-COP-3-Stab-1_B2a_stab	Stabilization of band 2a	22
8	HIFI-COP-4-Stab-2_B2a_dbs	DBS stability band 2a	124
9	HIFI-COP-4-Stab-2_B2a_lsw	Load-chop stability band 2a	124
10	HIFI-COP-3-Stab-1_B2b_stab	Stabilization of band 2b	22
11	HIFI-COP-4-Stab-2_B2b_dbs	DBS stability band 2b	124
12	HIFI-COP-4-Stab-2_B2b_lsw	Load-chop stability band 2b	124
13	HIFI-COP-3-Stab-1_B3a_stab	Stabilization of band 3a	22
14	HIFI-COP-4-Stab-2_B3a_dbs	DBS stability band 3a	124
15	HIFI-COP-4-Stab-2_B3a_lsw	Load-chop stability band 3a	124
16	HIFI-COP-3-Stab-1_B3b_stab	Stabilization of band 3b	22
17	HIFI-COP-4-Stab-2_B3b_dbs	DBS stability band 3b	124
18	HIFI-COP-4-Stab-2_B3b_lsw	Load-chop stability band 3b	124

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19	HIFI-COP-3-Stab-1_B4a_stab	Stabilization of band 4a	22
20	HIFI-COP-4-Stab-2_B4a_dbs	DBS stability band 4a	124
21	HIFI-COP-4-Stab-2_B4a_lsw	Load-chop stability band 4a	124
22	HIFI-COP-3-Stab-1_B4b_stab	Stabilization of band 4b	22
23	HIFI-COP-4-Stab-2_B4b_dbs	DBS stability band 4b	124
24	HIFI-COP-4-Stab-2_B4b_lsw	Load-chop stability band 4b	124
25	HIFI-COP-3-Stab-1_B5a_stab	Stabilization of band 5a	22
26	HIFI-COP-4-Stab-2_B5a_dbs	DBS stability band 5a	124
27	HIFI-COP-4-Stab-2_B5a_lsw	Load-chop stability band 5a	124
28	HIFI-COP-3-Stab-1_B5b_stab	Stabilization of band 5b	22
29	HIFI-COP-4-Stab-2_B5b_dbs	DBS stability band 5b	124
30	HIFI-COP-4-Stab-2_B5b_lsw	Load-chop stability band 5b	124
31	HIFI-COP-3-Stab-1_B6a_stab	Stabilization of band 6a	22
32	HIFI-COP-4-Stab-2_B6a_dbs	DBS stability band 6a	124
33	HIFI-COP-4-Stab-2_B6a_lsw	Load-chop stability band 6a	124
34	HIFI-COP-3-Stab-1_B6b_stab	Stabilization of band 6b	22
35	HIFI-COP-4-Stab-2_B6b_dbs	DBS stability band 6b	124
36	HIFI-COP-4-Stab-2_B6b_lsw	Load-chop stability band 6b	124
37	HIFI-COP-3-Stab-1_B7a_stab	Stabilization of band 7a	22
38	HIFI-COP-4-Stab-2_B7a_dbs	DBS stability band 7a	124
39	HIFI-COP-4-Stab-2_B7a_lsw	Load-chop stability band 7a	124
40	HIFI-COP-3-Stab-1_B7b_stab	Stabilization of band 7b	22
41	HIFI-COP-4-Stab-2_B7b_dbs	DBS stability band 7b	124
42	HIFI-COP-4-Stab-2_B7b_lsw	Load-chop stability band 7b	124

6.26 AOT Pre-validation – HIFI-COP-5-AOT1

6.26.1 Purpose

This test corresponds to the tier 1 of the COP-PV AOT validation activity. It here focuses on the AOT that will be used during the FPG measurements, as well as during the PV phase activity which will use AOT prior to the bulk of the AOT validation block. As such it addresses items such as the correct timing of the AOR rather than e.g. its adequacy to provide the best calibration to the data.

6.26.2 Pre-conditions

The instrument has been put into Standby-2 mode with the Nominal side. The previous blocks of the COP should have been performed successfully.

6.26.3 Constraints

It is preferred to run these tests with the cryo-cover open as strong continuum and/or line sources could be simultaneously observed “for free”. This latter option would offer a

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preliminary sanity check of the pointing prior to any dedicated FPG characterisation. In case this helps the COP scheduling, it can however be envisaged to run this early AOT-validation with the cryo-cover closed.

6.26.4 Execution Method

Default: MTL – MOIS is not an option here because tests will be prepared using HSpot or XHSpot.

6.26.5 Duration

The total duration, including slew tax, is 12.3h.

6.26.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM.

6.26.7 Procedure Sequence

Step#	Procedure name / AOR name	Purpose	Duration (min)
1	PV_HifiPointDBSNoCont_CI_1-0_v001	DBS validation CI (1a)	14
2	PV_HifiPointDBSNoCont_v001	DBS validation (7a)	105
3	PV_HifiMappingFastDBSCross-CO_6-5_v001	Fast DBS x-map validation CO (2a)	36
4	PV_HifiMappingFastDBSCrossNoCont-H2O_v001	Fast DBS No cont x-map validation H2O (7b)	34
5	PV_HifiMappingOTF-CO_9-8_v0001	OTF validation CO(9-8) (4a)	27
6	PV_HifiMappingDBSRaster_H2O_101-111_SSO_v001	DBS Raster on SSO validation H2O (1b)	228
7	PV_HifiMappingFastDBSRasterNoCont-CII_1901_v001	Fast DBS Raster No cont validation C+ (7b)	27
8	PV_HifiMappingDBSRasterNoCont-CO_10-9_v0001	OTF DBS CO(10-9) (5a)	29
9	PV_HifiMappingOTF-H2O_1670_SSO_v001	OTF validation SSO (6b)	240

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6.27 Focal Plane Geometry: first light – first order assessment – HIFI-COP-6-FPG1

6.27.1 Purpose

This test is HIFI first light. It consists in assessing a first-order estimate of the HIFI aperture positions with respect to the satellite bore-sight. This first step considers a sub-set of the HIFI apertures, being limited to 4 mixer band, each of which having 4 apertures assigned (2 polarizations, 2 chopper positions). The rest of the apertures will be boot-strapped to the measured ones, based on the knowledge collected during the pre-flight calibration campaigns.

For each mixer band, only one frequency will be considered. The two polarizations are measured simultaneously.

The test will consist in performing small squared rasters across calibration sources, using a double-beam switch (DBS) referencing scheme (chop + nod). The raster size will be 11x11 pt (TBC), fully-sampled. It is not foreseen to perform a peak-up prior to this measurement as the raster coverage is large enough to accommodate pointing performances (APE) far worst than the current specification.

6.27.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Pointing calibration at S/C level must have been completed, and its outcome propagated to the preparation of this test.

Success of the full COP sections prior to this test is a pre-requisite, with the possible exception of HIFI-COP-4-IF-FBk2, which could be programmed later.

6.27.3 Constraints

Cryo-cover must be open.

Constraints on SAA TBC.

Calibration source must be visible – prime calibrators are Mars, Uranus, Jupiter, Neptune, Saturn – basically any available planet would do. It is very likely that full sequence shall be done during the same OD.

6.27.4 Execution Method

Default: MTL – MOIS is not an option.

MTL is preferred because this test will point at celestial target and will benefit from the MPS to prepare the observation.

6.27.5 Duration

The anticipated duration of this measurement is 8h (TBC).

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6.27.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM.

6.27.7 Procedure Sequence

Step#	Procedure name	Purpose	Duration (min)
1	HIFI-COP-6-FPG1_B1	1 st FPG calibration in band 1	120
2	HIFI-COP-6-FPG1_B2	1 st FPG calibration in band 2	120
3	HIFI-COP-6-FPG1_B4	1 st FPG calibration in band 4	120
4	HIFI-COP-6-FPG1_B6	1 st FPG calibration in band 6	120

6.28 Focal Plane Geometry: refinement over all bands – HIFI-COP-6-FPG2

6.28.1 Purpose

This test is the second iteration on the determination of the position of the HIFI aperture with respect to the satellite bore-sight. Based on the first-order results collected in HIFI-COP-5-FPG1, smaller raster maps (DBS referencing scheme) are performed at one frequency for each mixer band. Again, both polarizations are measured simultaneously. The same remark as for HIFI-COP-5-FPG1 apply here.

6.28.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Pointing calibration at S/C level must have been completed, and its outcome propagated to the preparation of this test.

Success of HIFI-COP-6-FPG1 is a pre-requisite, in particular iteration on the SIAM matrix entries must have been done if needed.

6.28.3 Constraints

Cryo-cover must be open..

Constraints on SAA TBC.

Calibration source must be visible – prime calibrators are Mars, Uranus. It is very likely that full sequence shall be done during the same OD.

6.28.4 Execution Method

Default: MTL – MOIS is not an option.

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MTL is preferred because this test will point at celestial target and will benefit from the MPS to prepare the observation.

6.28.5 Duration

The anticipated duration of this measurement is 7.0h (TBC).

6.28.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK and Science TM.

6.28.7 Procedure Sequence

Step#	Procedure (AOR) name	Purpose	Duration (min)
1	HIFI-COP-6-FPG2_B1	2 nd FPG calibration in band 1	60
2	HIFI-COP-6-FPG2_B2	2 nd FPG calibration in band 2	60
3	HIFI-COP-6-FPG2_B3	2 nd FPG calibration in band 3	60
4	HIFI-COP-6-FPG2_B4	2 nd FPG calibration in band 4	60
5	HIFI-COP-6-FPG2_B5	2 nd FPG calibration in band 5	60
6	HIFI-COP-6-FPG2_B6	2 nd FPG calibration in band 6	60
7	HIFI-COP-6-FPG2_B7	2 nd FPG calibration in band 7	60

6.29 Peak-up Test – HIFI-COP-6-PU

6.29.1 Purpose

This test is dedicated to validate the peak-up observing mode. In this mode, the satellite performs a 3x3 pt raster across the target source and the instrument collects the flux measured towards each of the positions. The instrument ICU then computes the flux peak based on the passed astrometry and sends to the ACMS the offsets to apply to the original pointing request in order to be optimally centred on the target. Note that the offsets send will only apply to the very next pointing request. This mode is offered as a backup in case the pointing performance (APE) would be much worse than currently specified.

At this stage it is anticipated that PU should be only checked in bands 5, 6 and 7, where the beam size is small enough to be potentially affected by a significant pointing offset.

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6.29.2 Pre-conditions

The instrument is in Primary mode with the Nominal side. Pointing calibration at S/C level must have been completed, and its outcome propagated to the preparation of this test.

Success of HIFI-COP-6-FPG2 is a pre-requisite, in particular iteration on the SIAM matrix entries must have been done if needed.

6.29.3 Constraints

Cryo-cover must be open..

Constraints on SAA TBC.

Target source must be visible – list of peak-up sources TBD.

6.29.4 Execution Method

Default: MTL – MOIS is not an option.

MTL is preferred because this test will point at celestial target and will benefit from the MPS to prepare the observation.

6.29.5 Duration

The anticipated duration of this measurement is 0.5h (TBC).

6.29.6 Analysis data

The analysis of the data collected during this sub-block will rely on HK TM only.

6.29.7 Procedure Sequence

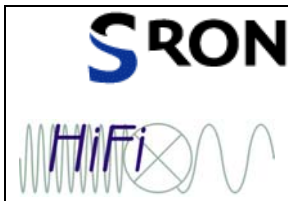
Step#	Procedure name	Purpose	Duration (min)
1	Dedicated MTL or HIFI-COP-6-PU_B5	PU test in band 5	10
2	Dedicated MTL or HIFI-COP-6-PU_B6	PU test in band 6	10
3	Dedicated MTL or HIFI-COP-6-PU_B7	PU test in band 7	10

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7 Appendix A: tentative detailed time-line of the COP blocks and sub-blocks

The following charts present a possible detailed time-line for the sub-blocks considered in the HIFI COP. The charts read as follows:

- For each box, the (shortened) name of sub-block is indicated. Mixer bands ($_x$) or LO band ($_xa/b$) are indicated as a suffix whenever applicable. For block 1, a further distinction is made between the Nominal (N) and the Redundant (R) side
- Below the name box, 3 numbers are indicated: the total accumulative time in **blue (in minutes)**, the actual execution time in **black (in minutes)**, and the expected analysis/turn-around time needed after a given sub-block is completed, in **red (in hours)**. Usually, the analysis can be deferred to the end of a full block, so that the time indicated counts for the analysis of the whole block. Ideally, during this dead-time slot, COP activities related to other instruments should be conducted
- The time-line also tries to account for mode transitions, although it does so only at the beginning and end of an activity block. Obviously, more of these transitions may be needed in order to leave the floor to other instruments, while a given block is not yet complete. In that sense, the number of mode transitions considered here is a lower limit. However, we assume that these transitions should take place in during the DTCP periods, so they should not be considered part of the 21h daily slots.
- The time-ordered sequence proposed in the charts tries to group sub-blocks of a given block that applies to the same instrument side, or to the same LO oscillator band, as switching on this latter can represent a non-negligible fraction of overheads. This usually implies that interlacing of the sub-blocks has no consequences on the moment when off-line analysis is required.

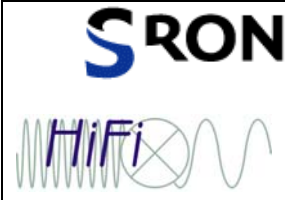


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SWITCH-ON-N	1.1-CPR1-N	1.1-CPR2-N	1.1-CPR3-N	1.2-WBS-FT-N	1.2-FPU-FT8-N	1.2-FPU-FT1-N
60	60.7	65.1	65.7	88.7	91	93.3
0	0.7	4.4	0.6	23	2.3	0
0	0	0	0	0	0	0
1.2-FPU-FT2-N	1.2-FPU-FT3-N	1.2-FPU-FT4-N	1.2-FPU-FT6-N	1.2-FPU-FT7-N	1.2-FPU-FT15-N	1.2-IF-FT2-N
95.7	98.1	101	103	103	103	104
2.4	2.4	2.4	0.15	0.15	0.5	0.5
0	0	0	0	0	0	0
1.2-IF-FT3-N	1.2-IF-FT4-N	1.2-IF-FT6-N	1.2-IF-FT7-N	1.2-IF-FT5-N	1.2-HRS-FT-N	1.2-LO-SFT1a-N
105	105	106	106	107	125	130
0.5	0.5	0.5	0.5	0.5	18	4.9
0	0	0	0	0	0	0
1.2-LO-SFT1b-N	1.2-LO-SFT2a-N	1.2-LO-SFT2b-N	1.2-LO-SFT3a-N	1.2-LO-SFT3b-N	1.2-LO-SFT4a-N	1.2-LO-SFT4b-N
134	141	147	154	160	165	170
4.9	6.4	6.4	6.4	6.7	4.9	4.9
0	0	0	0	0	0	0
1.2-LO-SFT5a-N	1.2-LO-SFT5b-N	1.2-LO-SFT6a-N	1.2-LO-SFT6b-N	1.2-LO-SFT7a-N	1.2-LO-SFT7b-N	1.2-CPR-RT-N
175	180	186	192	197	202	203
4.9	4.9	6.5	5.3	5.3	5.3	0.8
0	0	0	0	0	0	0
SWITCH-OFF-N	SWITCH-ON-R	1.1-CPR1-R	1.1-CPR2-R	1.1-CPR3-R	1.2-LO-SFT1a-R	1.2-LO-SFT1b-R
218	278	279	283	284	289	294
15	60	0.7	4.4	0.6	4.9	4.9
0	0	0	0	0	0	0
1.2-LO-SFT2a-R	1.2-LO-SFT2b-R	1.2-LO-SFT3a-R	1.2-LO-SFT3b-R	1.2-LO-SFT4a-R	1.2-LO-SFT4b-R	1.2-LO-SFT5a-R
300	306	313	320	324	329	334
6.4	6.4	6.4	6.7	4.9	4.9	4.9
0	0	0	0	0	0	0
1.2-LO-SFT5b-R	1.2-LO-SFT6a-R	1.2-LO-SFT6b-R	1.2-LO-SFT7a-R	1.2-LO-SFT7b-R	1.2-CPR-RT-R	
339	346	351	356	362	362	
4.9	6.5	5.3	5.3	5.3	0.8	
0	0	0	0	0	0	

Fig. 1: Time-line for block HIFI-COP-1



HiFi Commissioning Phase Plan

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Fig. 2: Time-line for block HiFi-COP-2.1 and HiFi-COP-2.2

PRIMARY-N	2.3-CPR-S1 1	2.3-CPR-S1 2	2.3-CPR-S1 3	2.3-CPR-S1 4	2.3-CPR-S1 5	2.3-CPR-S1 6								
10949	0	11016	67	11083	67	11150	67	11217	67	11284	67	11351	67	
2.3-CPR-S1 7	STBY-2-N	PRIMARY-N	3-Deflux	3-FTP-1a	3-StWv1 1a	3-Tsys 1a								
11418	67	12859	1	24	12859	0	12879	20	12921	42	12969	48	13034	65
3-FTP-1b	3-StWv1 1b	3-Tsys 1b	3-FTP-2a	3-StWv1 2a	3-Tsys 2a	3-FTP-2b								
13076	42	13124	48	13189	65	13231	42	13259	28	13344	85	13386	42	
3-StWv1 2b	3-Tsys 2b	3-FTP-3a	3-StWv1 3a	3-Tsys 3a	3-FTP-3b	3-StWv1 3b								
13414	28	13485	71	13528	43	13556	28	13601	45	13644	43	13672	28	
3-Tsys 3b	3-FTP-4a	3-StWv1 4a	3-Tsys 4a	3-FTP-4b	3-StWv1 4b	3-Tsys 4b								
13755	83	13798	43	13846	48	13938	92	13981	43	14029	48	14087	58	
3-FTP-5a	3-StWv1 5a	3-Tsys 5a	3-FTP-5b	3-StWv1 5b	3-Tsys 5b	3-FTP-6a								
14131	44	14160	29	14285	125	14329	44	14358	29	14483	125	14507	24	
3-StWv1 6a	3-Tsys 6a	3-FTP-6b	3-StWv1 6b	3-Tsys 6b	3-FTP-7a	3-StWv1 7a								
14535	28	14647	112	14671	24	14699	28	14798	99	14822	24	14870	48	
3-Tsys 7a	3-FTP-7b	3-StWv1 7b	3-Tsys 7b	STBY-2-N	3-FTP-7a	3-StWv1 7a								
14982	112	15006	24	15054	48	15194	140	18075	1	18075	1	18075	1	

Fig. 3: Time-line for block HIFI-COP-2.3 and first part of block HIFI-COP-3

PRIMARY-N	3--Stab1 1a--st	3--Stab1 1a--sy	3--Stab1 1a--in	3--Stab1 1a--fs	3--Stab1 1b--st	3--Stab1 1b--sy
18075	0	18216	18340	18470	18492	18589
	22	119	124	130	22	97
	0	0	0	0	0	0
3--Stab1 1b--in	3--Stab1 1b--fs	3--Stab1 2a--st	3--Stab1 2a--sy	3--Stab1 2a--in	3--Stab1 2a--fs	3--Stab1 2b--st
18713	124	18865	18984	19108	19239	19261
	130	22	119	124	131	22
	0	0	0	0	0	0
3--Stab1 2b--sy	3--Stab1 2b--in	3--Stab1 2b--fs	3--Stab1 3a--st	3--Stab1 3a--sy	3--Stab1 3a--in	3--Stab1 3a--fs
19401	140	19665	19687	19784	19908	20102
	140	130	22	97	124	194
	0	0	0	0	0	0
3--Stab1 3b--st	3--Stab1 3b--sy	3--Stab1 3b--in	3--Stab1 3b--fs	3--Stab1 4a--st	3--Stab1 4a--sy	3--Stab1 4a--in
20124	22	20367	20561	20583	20761	20885
	22	124	194	22	178	124
	0	0	0	0	0	0
3--Stab1 4a--fs	3--Stab1 4b--st	3--Stab1 4b--sy	3--Stab1 4b--in	3--Stab1 4b--fs	3--Stab1 5a--st	3--Stab1 5a--sy
21079	194	21220	21344	21538	21560	21657
	194	119	124	194	22	97
	0	0	0	0	0	0
3--Stab1 5a--in	3--Stab1 5a--fs	3--Stab1 5b--st	3--Stab1 5b--sy	3--Stab1 5b--in	3--Stab1 5b--fs	3--Stab1 6a--st
21781	124	21933	22009	22133	22263	22285
	124	22	76	124	130	22
	0	0	0	0	0	0
3--Stab1 6a--sy	3--Stab1 6a--in	3--Stab1 6a--fs	3--Stab1 6b--st	3--Stab1 6b--sy	3--Stab1 6b--in	3--Stab1 6b--fs
22404	119	22528	22680	22860	22984	23114
	119	124	22	180	124	130
	0	0	0	0	0	0
3--Stab1 7a--st	3--Stab1 7a--sy	3--Stab1 7a--in	3--Stab1 7a--fs	3--Stab1 7b--st	3--Stab1 7b--sy	3--Stab1 7b--in
23136	22	23291	23555	23577	23717	23841
	22	155	130	22	140	124
	0	0	0	0	0	0
3--Stab1 7b--fs	3--Spur-3b	3--Spur-7b	STBY-2-N			
23971	130	24004	24037	25478	1	24
	130	33	33	1		

Fig. 4: Time-line for the second part of block HIFI-COP-3



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OPEN-CRYO-COVER	PRIMARY-N	4-IF-FBK2 1	4-IF-FBK2 2	4-IF-FBK2 3	4-IF-FBK2 4	4-IF-FBK2 5
25478	0	25579	25680	25781	25882	25983
	0	101	101	101	101	101
	0	0	0	0	0	0
4-IF-FBK2 6	4-IF-FBK2 7	4-CPR-S2 1	4-CPR-S2 2	4-CPR-S2 3	4-CPR-S2 4	4-CPR-S2 5
26084	101	26252	26319	26386	26453	26520
	101	67	67	67	67	67
	0	0	0	0	0	0
4-CPR-S2 6	4-CPR-S2 7	STBY-2-N	PRIMARY-N	4-Stab2 1a st	4-Stab2 1a db	4-Stab2 1a ls
26587	67	28095	28095	28117	28241	28365
	67	1	24	22	124	124
	0	0	0	0	0	0
4-Stab2 1b st	4-Stab2 1b db	4-Stab2 1b ls	4-Stab2 2a st	4-Stab2 2a db	4-Stab2 2a ls	4-Stab2 2b st
28387	22	28511	28657	28781	28905	28927
	22	124	124	124	124	22
	0	0	0	0	0	0
4-Stab2 2b db	4-Stab2 2b ls	4-Stab2 3a st	4-Stab2 3a db	4-Stab2 3a ls	4-Stab2 3b st	4-Stab2 3b db
29051	124	29175	29321	29445	29467	29591
	124	124	124	124	22	124
	0	0	0	0	0	0
4-Stab2 3b ls	4-Stab2 4a st	4-Stab2 4a db	4-Stab2 4a ls	4-Stab2 4b st	4-Stab2 4b db	4-Stab2 4b ls
29715	124	29737	29985	30007	30131	30255
	124	22	124	22	124	124
	0	0	0	0	0	0
4-Stab2 5a st	4-Stab2 5a db	4-Stab2 5a ls	4-Stab2 5b st	4-Stab2 5b db	4-Stab2 5b ls	4-Stab2 6a st
30277	22	30401	30547	30671	30795	30817
	22	124	22	124	124	22
	0	0	0	0	0	0
4-Stab2 6a db	4-Stab2 6a ls	4-Stab2 6b st	4-Stab2 6b db	4-Stab2 6b ls	4-Stab2 7a st	4-Stab2 7a db
30941	124	31065	31211	31335	31357	31481
	124	124	124	124	22	124
	0	0	0	0	0	0
4-Stab2 7a ls	4-Stab2 7b st	4-Stab2 7b db	4-Stab2 7b ls	STBY-2-N		
31605	124	31627	31875	36196	1	72
	124	22	124	0	1	72
	0	0	0	0	0	0

Fig. 5: Time-line for block HIFI-COP-4

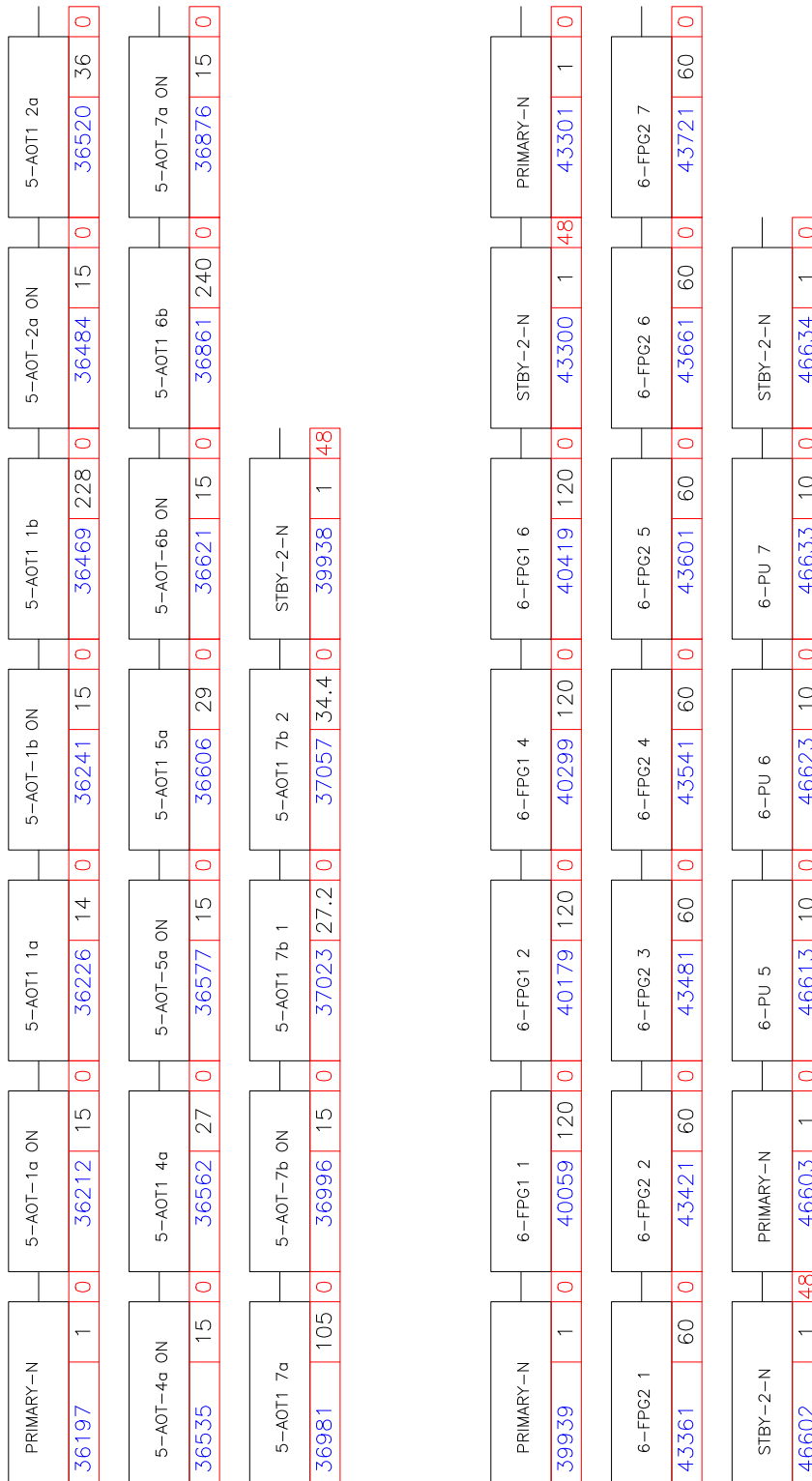


Fig. 6: Time-line for blocks HIFI-COP-5 and HIFI-COP-6

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8 Appendix B: detailed duration of COP sub-blocks

The following table expands the time break-down compiled in section 6.1. It however only concentrates on the test execution time. Overheads for mode transitions and off-line analysis are usually shared among several sub-blocks and their overall charge is best illustrated in 6.1.

Sub-block	Total execution time (h)	Sub-block	Total execution time (h)
HIFI-COP-1.1-CPR1	1.4 min.	HIFI-COP-2.2-VecScanCal	30.7
HIFI-COP-1.1-CPR2	8.8 min.	HIFI-COP-2.3-CPR-Scan1	7.8
HIFI-COP-1.1-CPR3	1.2 min.	HIFI-COP-3-Deflux	13.4
HIFI-COP-1.2-WBS_FT	0.4	HIFI-COP-3-FTP	8
HIFI-COP-1.2-FPU_FT	0.25	HIFI-COP-3-StWv1	8.5
HIFI-COP-1.2-HRS_FT	0.3	HIFI-COP-3-Tsys	21.3
HIFI-COP-1.2-IF_FT	3.5 min	HIFI-COP-3-Stab-1	96
HIFI-COP-1.2-LO_FT	2.6	HIFI-COP-3-Spur	4.1
HIFI-COP-1.2-CPR-RespTime	1.6 min.	HIFI-COP-4-IF-Fbk2	11.8
HIFI-COP-2.1-DipCal1	5.7	HIFI-COP-4-Stab-2	63
HIFI-COP-2.1-FTUnp	0.41	HIFI-COP-5-AOT1	12.3
HIFI-COP-2.1-IF-FBk1	11.8	HIFI-COP-6-FPG1	8
HIFI-COP-2.1-Stab-IF	5.95	HIFI-COP-6-FPG2	7
HIFI-COP-2.2-DipCal2	3.1	HIFI-COP-6-PU	0.5

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9 Change matrix for LUT files in the course of the COP

Configuration file	Config fpu	Config chopper	Config diplexer	LOU/LSU						Tsys	Chopper deatime	ALLAN TIMES						
				Config_safe_value	Config_lcu	Cpnmfig_blue_limit	Config_lcu_tuine	LCU safety tables	skychop_allan			load_allan	fs_allan	allan_system	lchop_allan	FSW throw	SIAM	
1.1-CPR1		X																
1.1-CPR2		X																
1.1-CPR3		X																
1.2-WBS_FT																		
1.2-FPU_FT																		
1.2-HRS_FT																		
1.2-UPC_FT																		
1.2-LO_FT				X	X	X	X	X										
1.2-CPR-RespTime										X								
2.1-DipCal1			X															
2.1-FTUnp	X																	
2.1-IF-FBk1																		
2.1-Stab-IF																		
2.2-DipCal2			X															
2.2-VecScanCal				X	X	X	X	X										
2.3-CPR-Scan1	X																	
3-Deflux																		
3-FTP																		
3-StWv1																	X	
3-Tsys									X									
3-Stab-1													X					
3-Spur				X														
4-IF-Fbk2																		
4-Stab-2													X					
5-AOT1																		
6-FPG1																		X
6-FPG2																		X
6-PU																		