Title: **Herschel PLM/ EQM AIT Plan**

CI-No:

Prepared by:	P. Mack	Date: 30.08.04
Checked by:	C. Schlosser	30.8.04
Product Assurance: for	R. Stritter	30.8.04
Configuration Control:	W. Wietbrock	31.08.04
Project Management: for	W. Rühe	31.08.04

Distribution: See Distribution List (last page)

Issue	Date	Sheet	Description of Change	Release
Issue 1	12.03.02	all	Initial Issue	
Issue 2	12.03.04	all	Complete revision of Issue 1 reflecting the development of the EQM programme	
Issue 2.1	29.04.04	20-25 24	Formatting problems Update of table	
Issue 2.2	30.08.04	all	changes according to H-EPLM CDR: – chapter with EMC set-up added – EMC tests defined according to CDR HAIV-Panel minutes – MIP, KIP, TRR etc. changed according to RID-11210	

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1 INTRODUCTION

In order to verify the performance of the instruments in an early phase of the Herschel program an electrical/engineering qualification model the EQM will be used and is based on the refurbished and modified ISO-Cryostat (QM). The ISO QM has to be seen as a test cryostat to provide the cryogenic in flight environment condition for the instruments.

The purpose of using the Herschel EQM is to perform the following tests prior to the PFM program:

- Functional test of the scientific instruments
- EMC test (RS)
- Pre-validation of Payload thermal design w.r.t. instrument thermal interfaces
- Verification of the payload instrument integration procedure
- First functional check of the EGSE (H/W and S/W) and EGSE Test Procedure preparation/evaluation

General:

The present document is an updated issue which reflects to the actual situation of the Herschel EQM programme. This new issue takes into account the delayed delivery of the FPU's and further associated EQM components. According customer request the time of waiting for hardware availability will be used to implement an additional test sequence before starting with the baseline EQM integration and test phase. This additional sequence will include mainly the early verification of the modified ISO cryostat in terms of leak tightness and the training of cryo/vacuum service personnel. For this training phase the cryostat internal cooling system modification will be completed to the maximum possible extend but some, especially instrument related H/W will be in a temporary status i. e. the optical bench is replaced by an optical bench dummy without any FPU's . Detailed H/W configuration for the training phase will be given in chapter 4.1.

1.1 OBJECTIVE

This Assembly, Integration and Test Plan (AIT Plan) describes all integration and test activities for the Herschel PLM/EQM program performed by EADS Astrium GmbH.
The major objectives of this AIT Plan are to define the technical basis for the following activities:

- An AIT programme in accordance with the system level AIV requirements
- The relevant organisation, necessary to carry out all tasks of the AIT programme
- The definition and utilisation of GSE and facilities dedicated to this programme
- The required integration/test documentation
- All tests and operations to be performed within the identified tasks
- The general company rules, PA and safety procedures to be followed throughout the AIT activities
- The AIT programme schedule and the major milestones
- The integration and test sequences
- Transports

2 DOCUMENTS

2.1 APPLICABLE DOCUMENTS (AD)

Applicable documents (AD) are defined as being documents which are needed to complete the work, they are considered as being integral part of this document, as far as specifically called-up.

The following documents in their latest issue are applicable to the specification :

AD #	Document Title	Document Identifier
AD 01	Instrument Interface Document IID – part A	SCI-PT-IIDA-04624
AD 02	Instrument Interface Document IID – part B, HIFI	SCI-PT-IIDB/HIFI-02125
AD 03	Instrument Interface Document IID – part B, PACS	SCI-PT-IIDB/PACS-02126
AD 04	Instrument Interface Document IID – part B, SPIRE	SCI-PT-IIDB/SPIRE-02124
AD 05	HERSCHEL EPLM AIV and HERSCHEL Satellite AIT Requirements Specification	HP-1-ASPI-SP-0008
AD 06	H-EPLM Requirements Specification	HP-2-ASED-SP-0003
AD 07	EMC Requirements Specification	H-P-1-ASPI-SP-0037
AD 08	Contamination Control Plan	HP-2-ASED-PL-0023
AD 09	PA Plan	HP-2-ASED-PL-0007
AD 10	EGSE General Requirement Specification	HP-1-ASPI-SP-0045
AD 11	Herschel/Plank DDP	H-P-1-ASPI-PL-0009
AD 12	Spire EQM Test Plan	SPIRE-RAL-DOC-0019505

2.2 REFERENCE DOCUMENTS (RD)

RD 01	Facility and Transportation Plan	HP-2-ASED-PL-0014
RD 02	EQM Test Program Definition	HP-2-ASED-TN-0004
RD 03	List of Acronyms	H-P-1-ASPI-LI-0077
RD 04	Instrument Testing on PLM EQM Level	HP-2-ASED-PL-0021
RD 05	Herschel EQM Design Description	HP-2-ASED-RP-0028
RD 06	ISO PLM/QM Inspection and Status Verification before Deintegration	HP-2-ASED-PR-0005
RD 07	Alignment Method, Plan & Results	HP-2-ASED-TN-0097
RD 08	Cryostat Cover Design Report	HP-2-AAE-RP-0005
RD 09	Optical Bench Assembly (OBA) Technical description	HP-2-SEN-TD-0001
RD 10	He Subsystem Specification	HP-2-ASED-SP-0015
RD 11	Modification of ISO/QM internal He tubing to Herschel EQM status	HP-2-ASED-PR-0007

3 EQM MODEL PHILOSOPHY

The Herschel design and development planning is based on a two model philosophy:

- The PLM/EQM, as electrical/engineering qualification model with flight representative instrument components (CQM's), based on the refurbished and modified ISO cryostat (QM). This is described within this AIT plan.
- The PLM/PFM, used for qualification and acceptance testing, which will be subject of the Herschel Satellite AIT plan.

4 EQM DESIGN DESCRIPTION

4.1 PLM EQM H/W CONFIGURATION

The main components of the EQM are (as given in figures on next pages):

- Test cryostat based on ISO/QM cryostat with the following major changes:
  - Main tank (torus) used as He I reservoir for the ventline-cooling of the heatshields only
  - New auxiliary tank as He II reservoir instead of the ISO auxiliary tank for the instrument cooling loop
  - Internal harness/sensors electrically representative to PFM (as far as useful)
  - ISO Baffle dismounted
  - ISO OSS dismounted
- Optical bench and instrument shield in Herschel FM design with HIFI-, PACS-, and SPIRE Focal Plane Units mounted on the optical bench and the HIFI LOU mounted on the outside of the CVV, all these instrument units with cryogenic qualification status
- Instrument cryo harness SIH plus LOU waveguide assembly, both flight representative
- CVV upper part identical to Herschel FM (including shields and MLI)
- Additional connector ring for scientific instrument harness vacuum feedthroughs
- Additional He S/S components for new EQM design (e.g. burst disc and safety valve for AXT)
- Additional ventline for auxiliary tank with manual ventvalve V512
- He S/S internal tubing adapted to new EQM design
- PLM EQM Cryostat Cover to simulate orbital representative background conditions, equipped with I/F's for transferline to allow active cooling of the instrument shield from a external LHe dewar
- SVM platform with support frame, equipped with warm units AVM's. Arrangement of SVM platform representative to PFM in position and size (wave guide configuration and external instrument harness routing identical to PFM) see Fig.: 3
- Cryostat harness shall be electrically representative to PFM
- For instrument testing the cryostat together with SVM simulator can be tilted around z-axis

4.1.1 PLM H/W CONFIGURATION FOR TRAINING PHASE

Deviating from the description before the main discrepancies of H/W configuration for the training phase are as follows:

- Optical bench and instrument shield replaced by optical bench dummy
- EQM cryostat cover replaced by over closing plate
- Internal He cooling loop closed by connection tube and supported by optical bench dummy
- LOU windows in CVV upper bulkhead blind flanged
- Connector vacuum feedthroughs in CVV connector ring replaced by blind connector feedthroughs

- SIH not installed
- LOU and waveguides not installed tbc.
- SVM simulator structure not installed

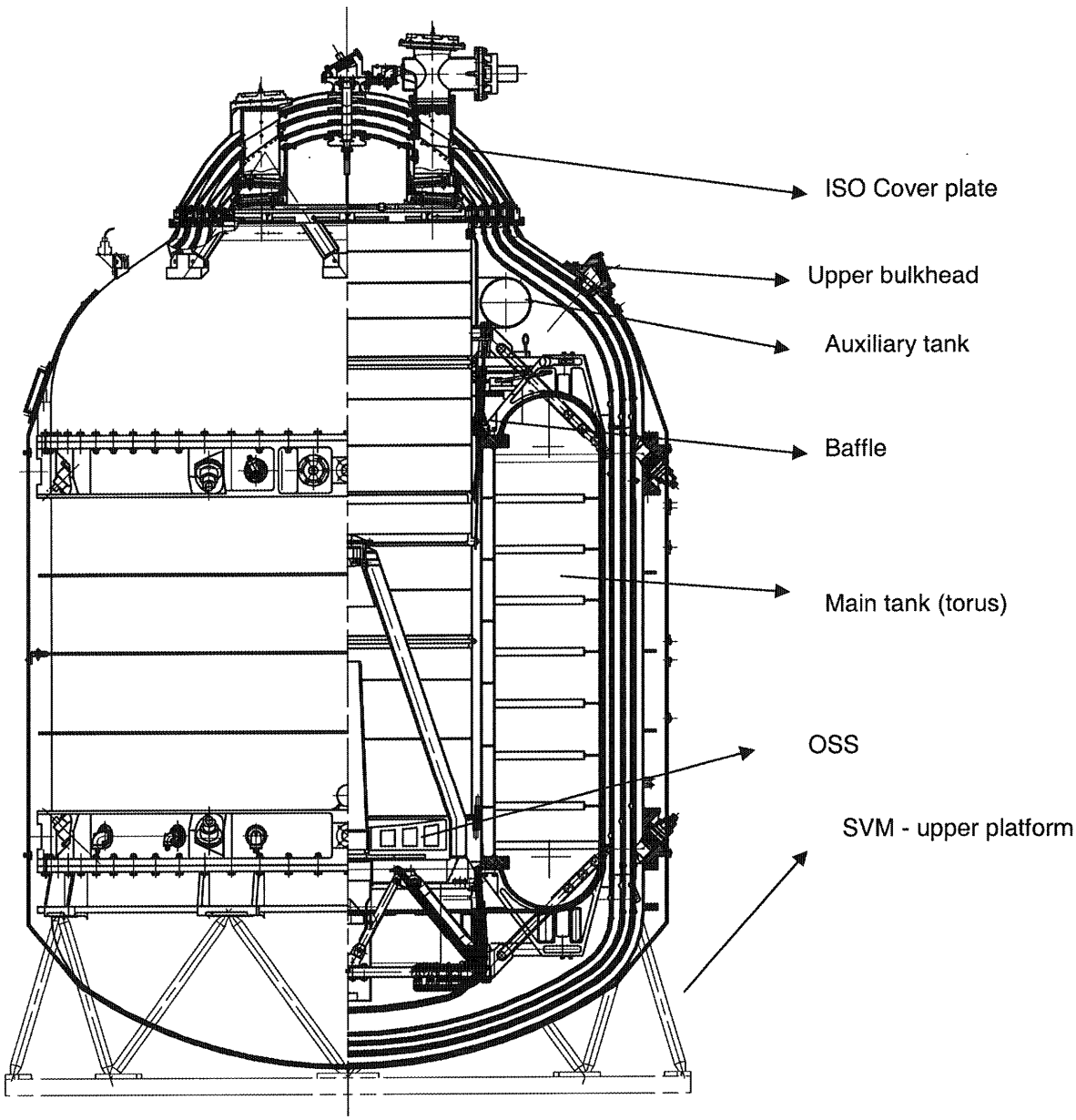


Figure 4-1: ISO PLM/QM – Parts to be disassembled

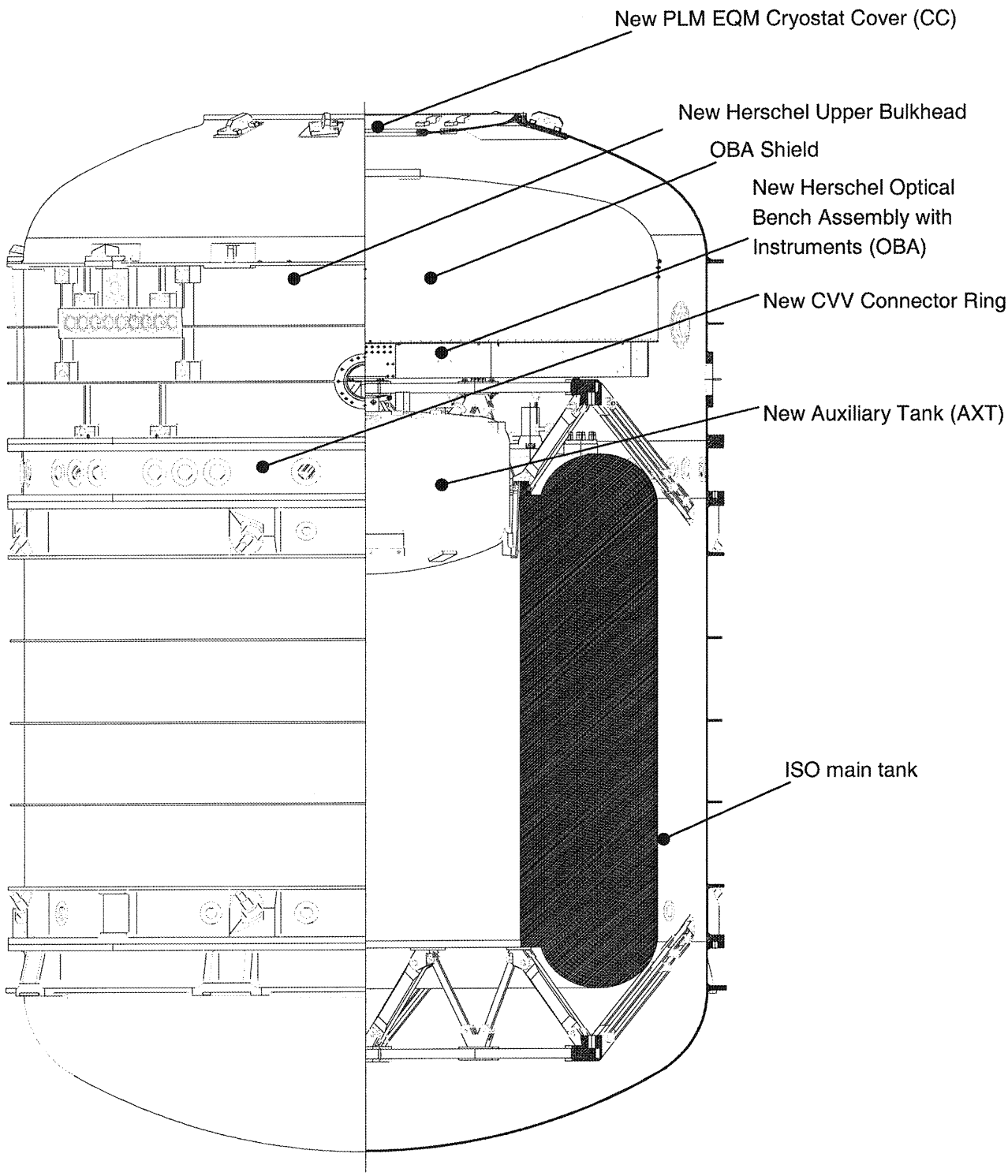


Figure 4-2: Main components to be integrated to Herschel EQM

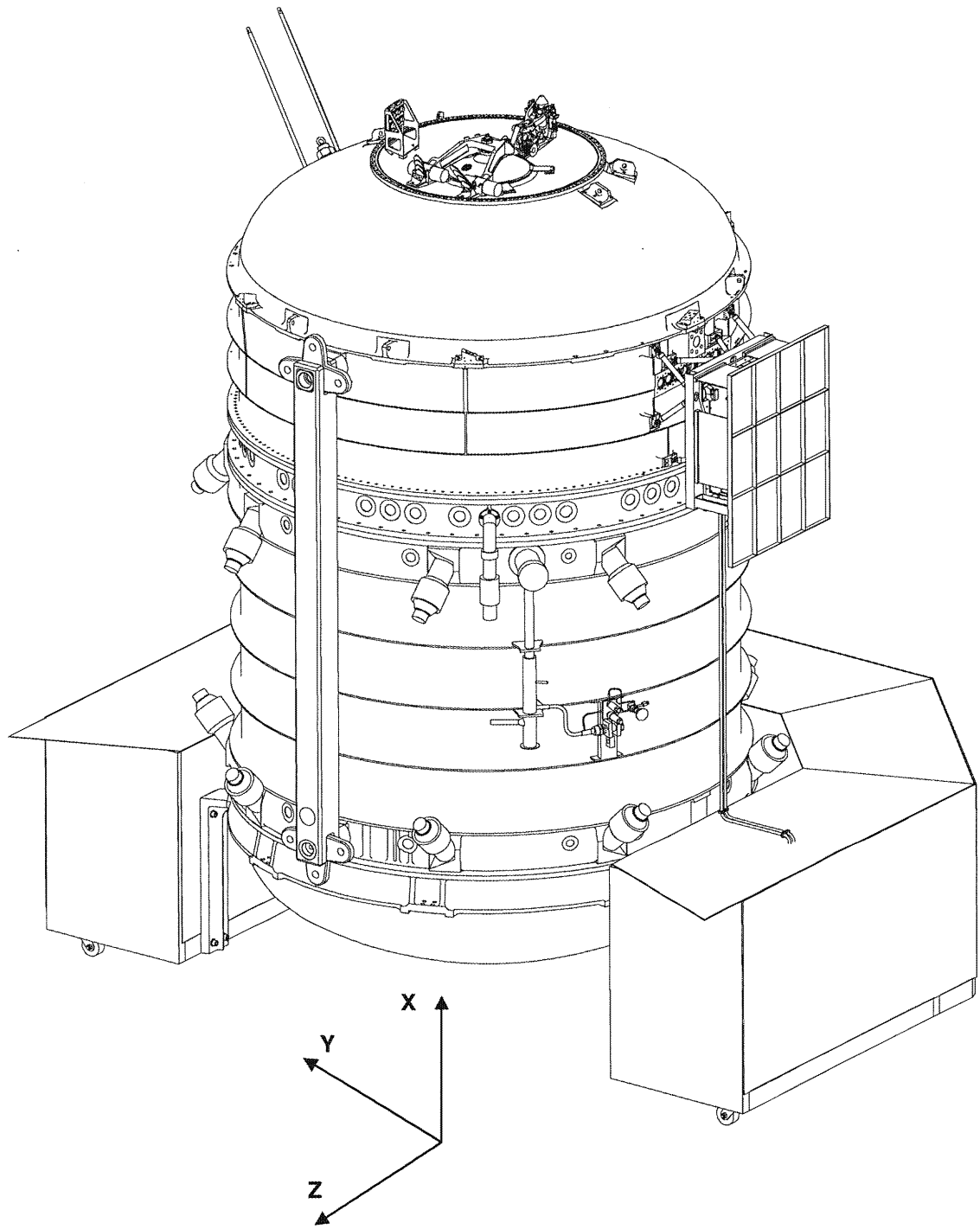


Figure 4-3: 3D view of PLM/EQM with SVM simulator

4.2 INSTRUMENT THERMAL REQUIREMENTS

The thermal requirements for the three different instrument temperature levels are as specified in AD2, AD3 and AD4.

	Minimum - Maximum I/F temperature	Max. I/F Temp. @ max. Heat Load	
	HIFI	**PACS**	**SPIRE**
Level 0	0 K ... 2 K stability: 6 mK/100s	1.75 K @ 0,8 mW 2 K @ 2 mW 5 K @ 2 mW 10K @ 500 mW	2 K @ 4 mW 2 K @ 2 mW 10K @ 500 mW peak 1.85 K @ 15 mW
Level 1	0 K ... 6 K stability: 6 mK/100s	5 K @ 10 mW	3.7 K @ 13 mW
Level 2	0 K ... 20 K stability: 15 mK/100s	12 K @ no load	8 K @ no load
Level 3	n.a.	n.a	15 K @ 25 mW 15 K @ 50 mW

Table 4-1: Summary of instrument thermal requirements

4.3 EQM HELIUM SUBSYSTEM

In order to fulfil the above given requirements for instrument testing the EQM He subsystem will be realised as given in figure below.

Main characteristics of this concept are as follows:

- The main tank will be filled with He-I at 4.2 K. For instrument testing it will be used to cool down the shields only (bypassing the optical bench) to nearly orbital temperature, i. e. approx. 30 K at the innermost shield. This temperature condition will be achieved by heating the main tank accordingly. The main tank is venting via V502 to ambient environment
- The AXT will be located within the upper part of the torus main tank. The shape of the upper part of the AXT will be similar to the shape of the Herschel EPLM main tank which will support a EPLM representative thermal coupling by Cu straps of the instruments
- The fixation of the AXT to the main tank will be realised by isolated CFK blades (shortened ISO baffle suspension)
- The auxiliary tank will be used as a He-II tank, to cool down the optical bench with the required flight representative mass flow of approx. 2.2 mg/sec. This will be realised by pumping at the new additional AXT ventline that is connected with the Herschel payload ventline. The adjustment of the required mass flow will be done by heating of the AXT and throttling the pumping capacity

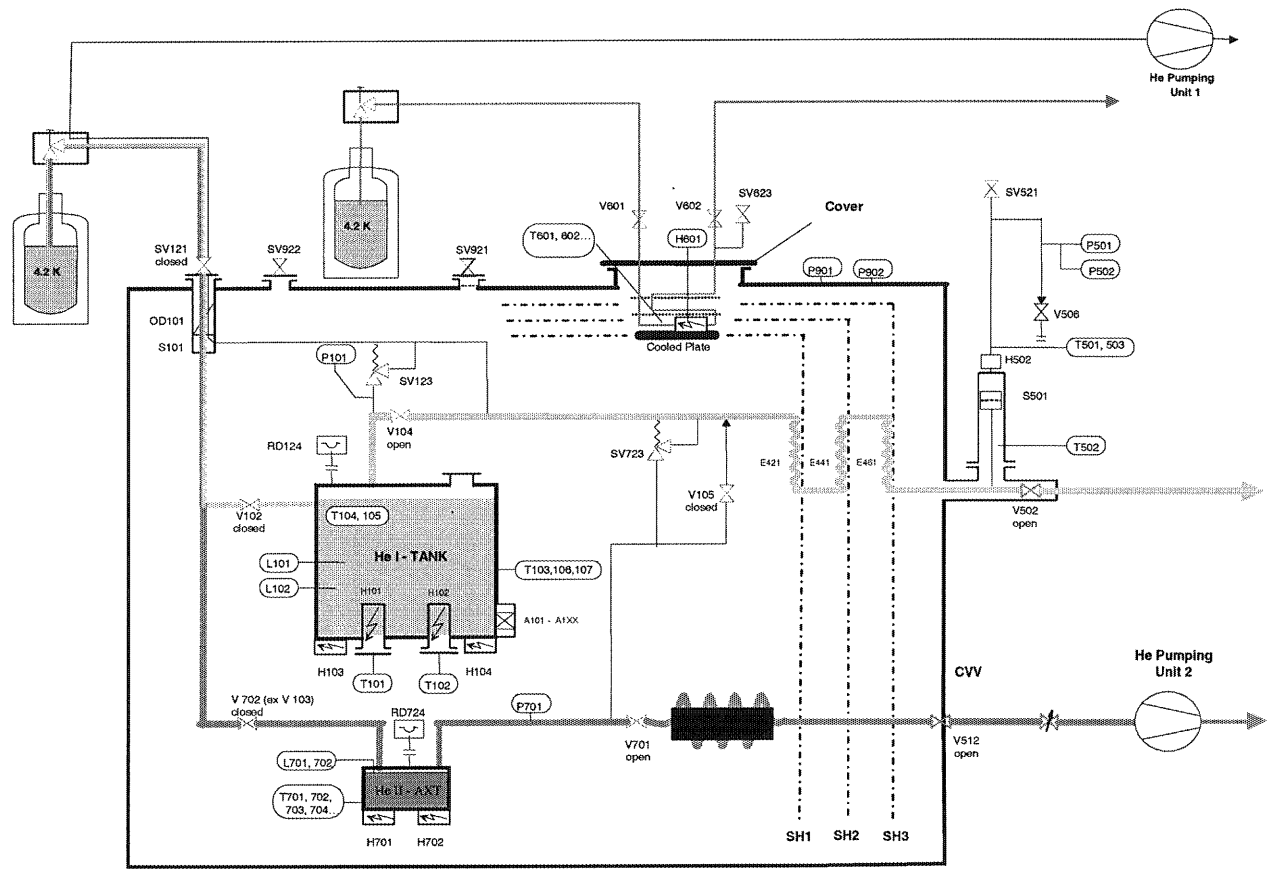


Figure 4-4: EQM Helium Subsystem Flow Schema

4.4 PLM EQM CRYOSTAT COVER

The PLM EQM Cryostat Cover (CC) is used to provide the test environment (replicating of the correct thermal background) for:

- Functional tests of HIFI, PACS and SPIRE instruments;
- Performance of conducted susceptibility under flight representative conditions

during the EQM test programme. The EQM CC H/W is the flight spare item of the PFM CC and is manufactured from the refurbished H/W of the PFM CC qualification model. The PLM EQM CC is a **fully flight representative** model. For the EQM programme the cover cryostat baffle will not be mounted.

Main functions of the CC applicable for the EQM programme are:

- to provide a vacuum-tight closure of the cryostat aperture
- to prevent contamination from the instruments on ground.
- Installed cooling loop within the vacuum tight plate.
- interface of cooling loop to the external cryo. lines provided by 2 Johnsten Coupling devices with integrated backflow valves
- to allow cover flushing (active cooling) with liquid helium or nitrogen tbc. during instrument testing.

The EQM CC consists of (main subassemblies only) as given in figure on next page:

- Door structure with incorporated O-ring sealing
- Cover Head shield (CHS)
- Lever
- Deployment mechanism (DEM) not need on EQM
- Hold down release mechanism (HRM)
- End stops
- Kick springs
- Connector bracket
- CVV top plate

For more details refer to RD 08 Cryo Cover design description

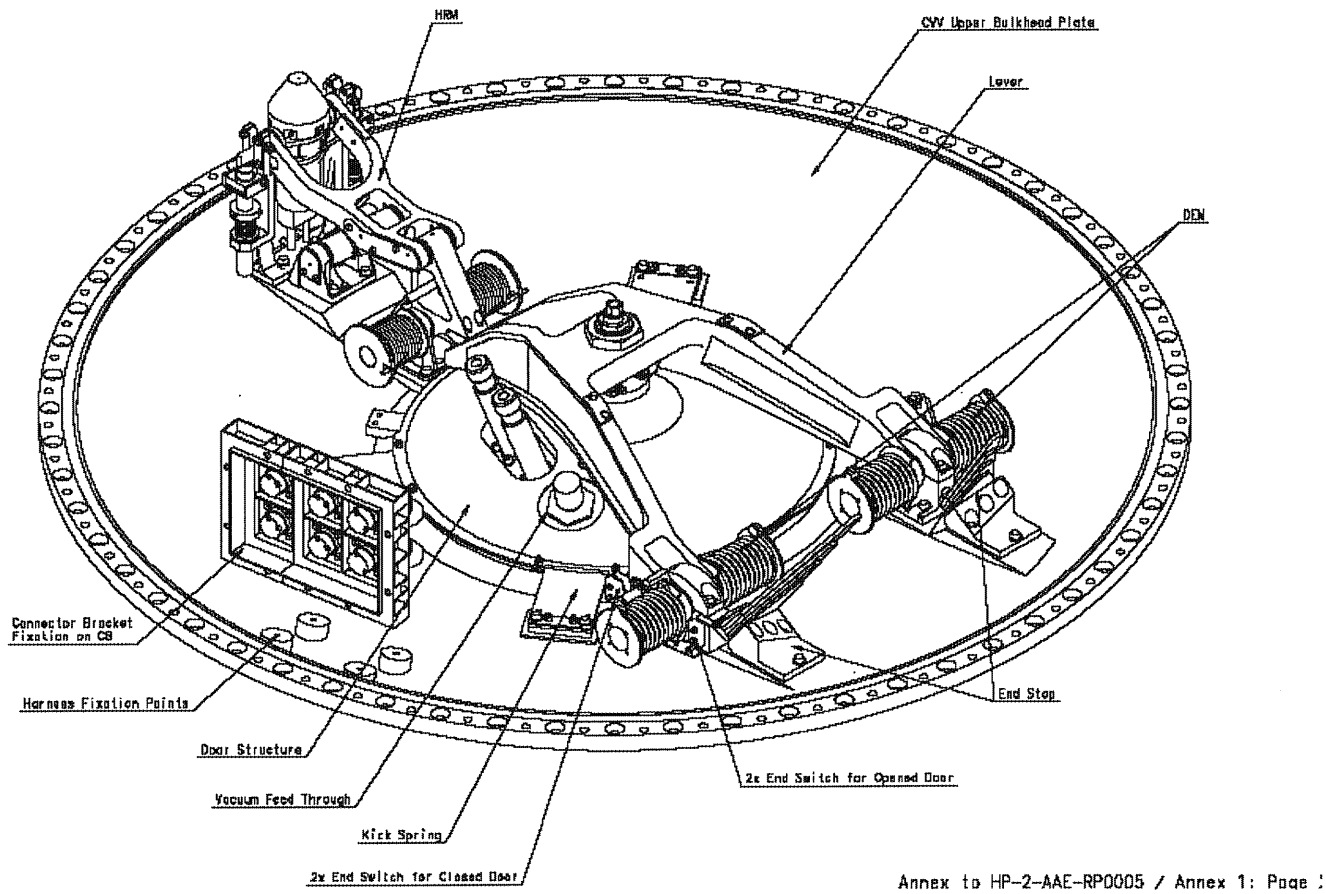


Figure 4-5: Main subassemblies of PLM EQM Cryostat Cover

4.4.1 EQM CRYO COVER PLATE

The EQM Cryo. Cover Plate is used to close the cryostat during the training phase and to allow cool down as well as HeI and HeII filling operations of the PLM. The cryo. cover plate is a non flight item and temporary installed which have to be exchanged by the cryo. cover CC for instrument testing

4.5 OPTICAL BENCH ASSEMBLY (OBA)

The basic function of the OBA is to provide a mechanical, thermal and radiative environment for the scientific Instruments Focal Plane Units (FPU's). In particular, the following main functions can be identified:

- To provide a solid and alignment stable support for the FPU's within the Herschel EQM cryogenic environment
- To protect the instruments from stray light
- To provide thermal path from Helium tank to instruments at different levels

The OBA used or the EQM programme is the QM, which will be used later on as flight spare

The OBA consists of the following components:

- Optical Bench Plate (OBP) with helium cooling loops supporting structures and special adapted mounting brackets to the ISO EQM Spatial Framework (SFW) and
- Optical Bench Shield (OBS), including entrance and LOU baffles
- Optical Bench Helium cooling loops (OBHCL), including mounting brackets
- Thermal interface links to scientific instruments (OBTL)

The main differences in OBA EQM and OBA PFM design are level 0 thermal links (for the EQM the OB Level 0 thermal links I/F's are provided in top of AXT), level 0 light tightness devices and SFW and OBA support brackets I/F to SFW. For more details refer to RD tbd Optical Bench Assembly (OBA) Technical description.

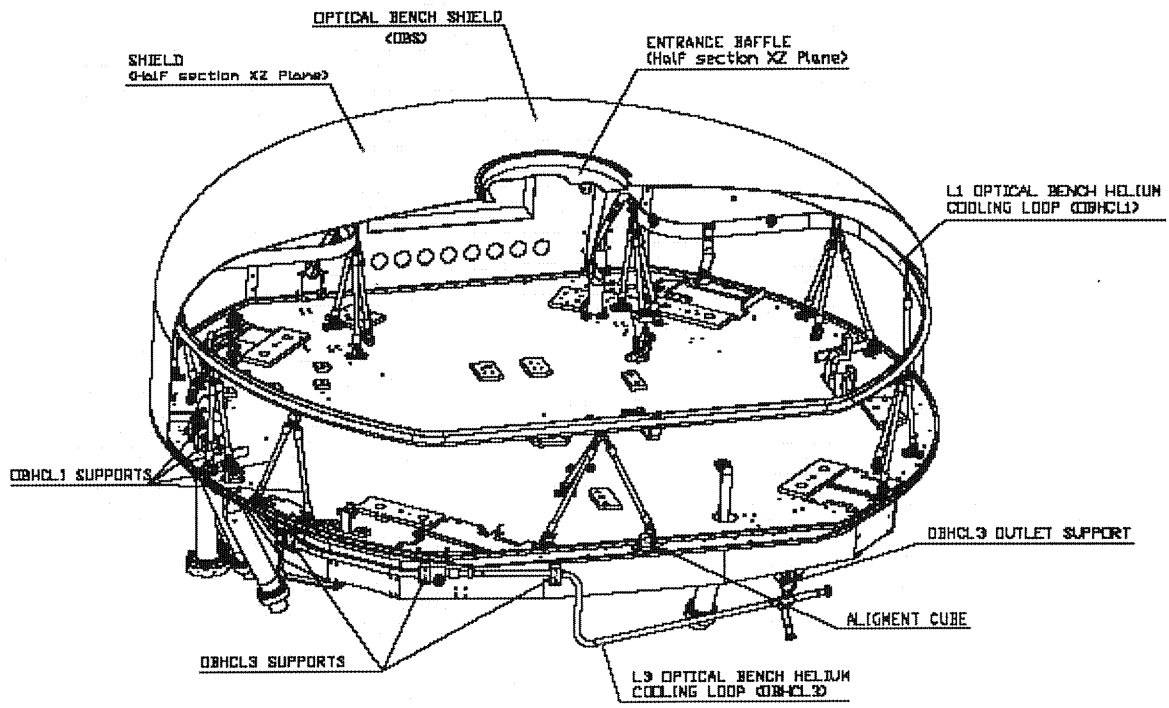


Figure 4-6: Optical Bench Main subassemblies

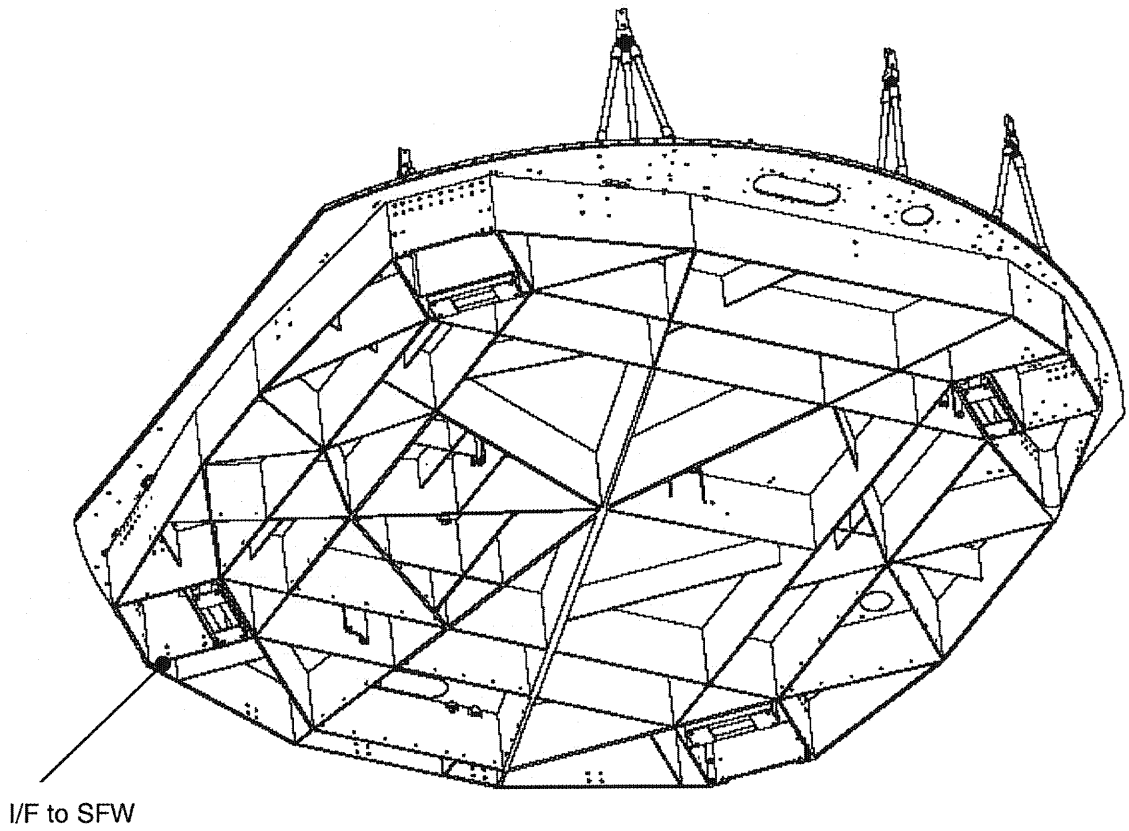


Figure 4-7: Optical bench bottom view

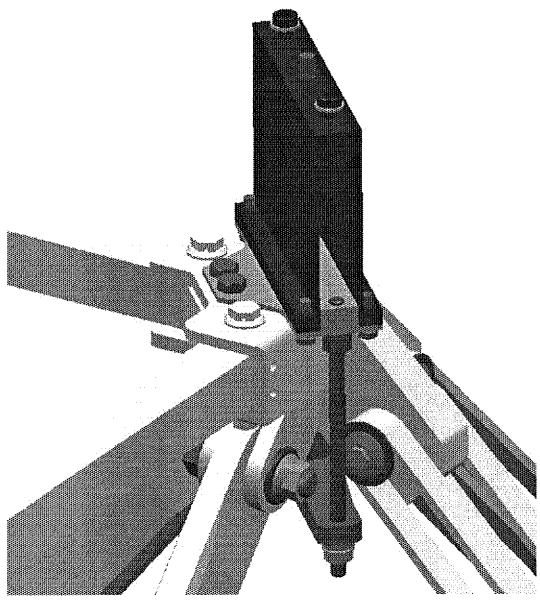


Figure 4-8: EQM Optical bench support bracket configuration

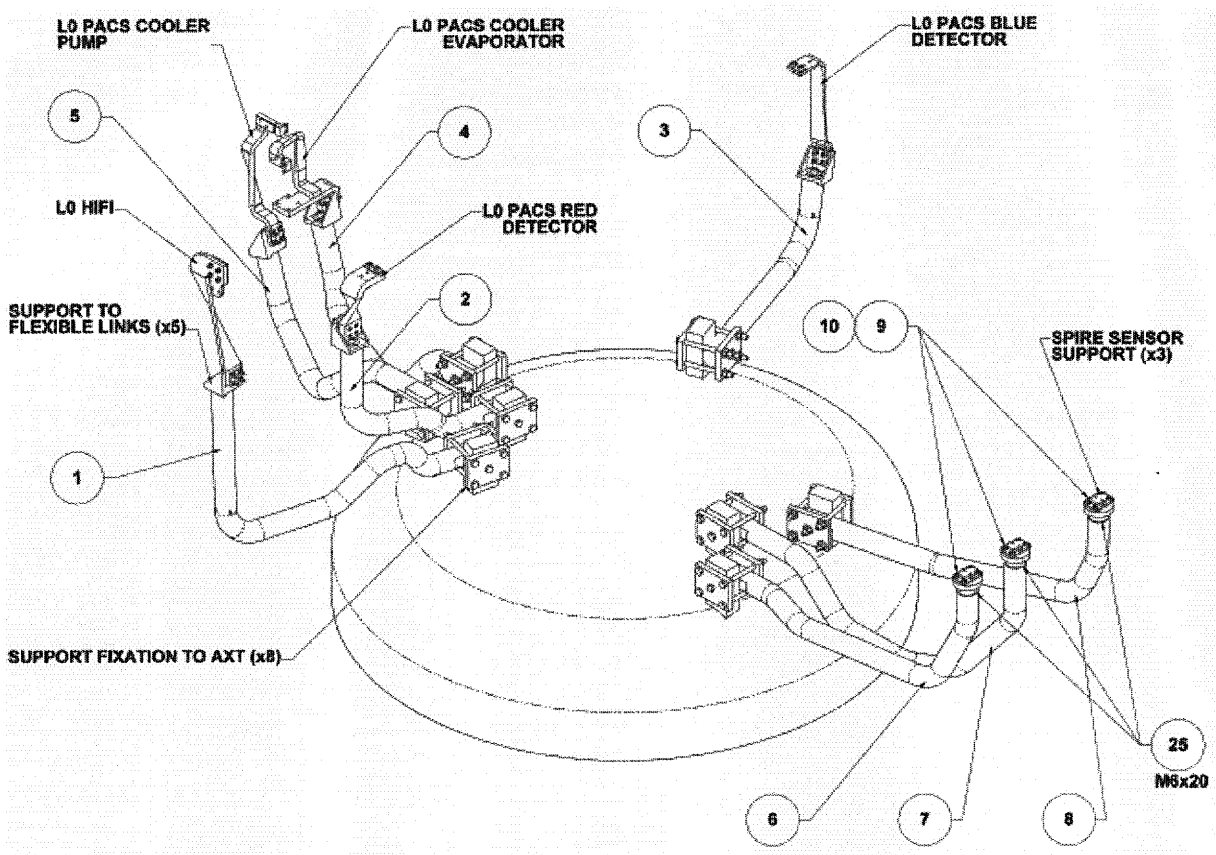


Figure 4-9: AXT Level 0 links and associated OB I/F's

4.5.1 OPTICAL BENCH TEMPLPLATE (OBTP)

For the training phase the OBA will not be installed and is replaced by the OBTP. A connection tube supported by the OBTP will close the PLM internal He cooling loop as replacement for the OBA tubing circuit. The OBTP is without any mechanical and electrical instrument I/F's with exception of harness cut-outs implemented in OBTP representative to cut-outs of the OBA. Fixation of the OBTP to PLM upper spatial framework is performed by use of 4 existing ISO Hel tank support blades. The OBTP is a temporary installed item which has to be exchanged for instrument testing

4.6 AUXILIARY TANK (AXT)

The AXT is a major part of the Herschel EQM and will serve as the reservoir for the liquid Helium (HeII). He will provide the cooling power for the actively cooled components on the optical bench. Cooling power will be transferred to the instruments by the evaporating LHe through the helium tubing system and by conductance through the level 0 thermal struts attached to the inner and outer tank surface.

The AXT is attached to the upper flange of the ISO main tank using 8 existing CFRP support blades (modified former ISO baffle support). GSE item

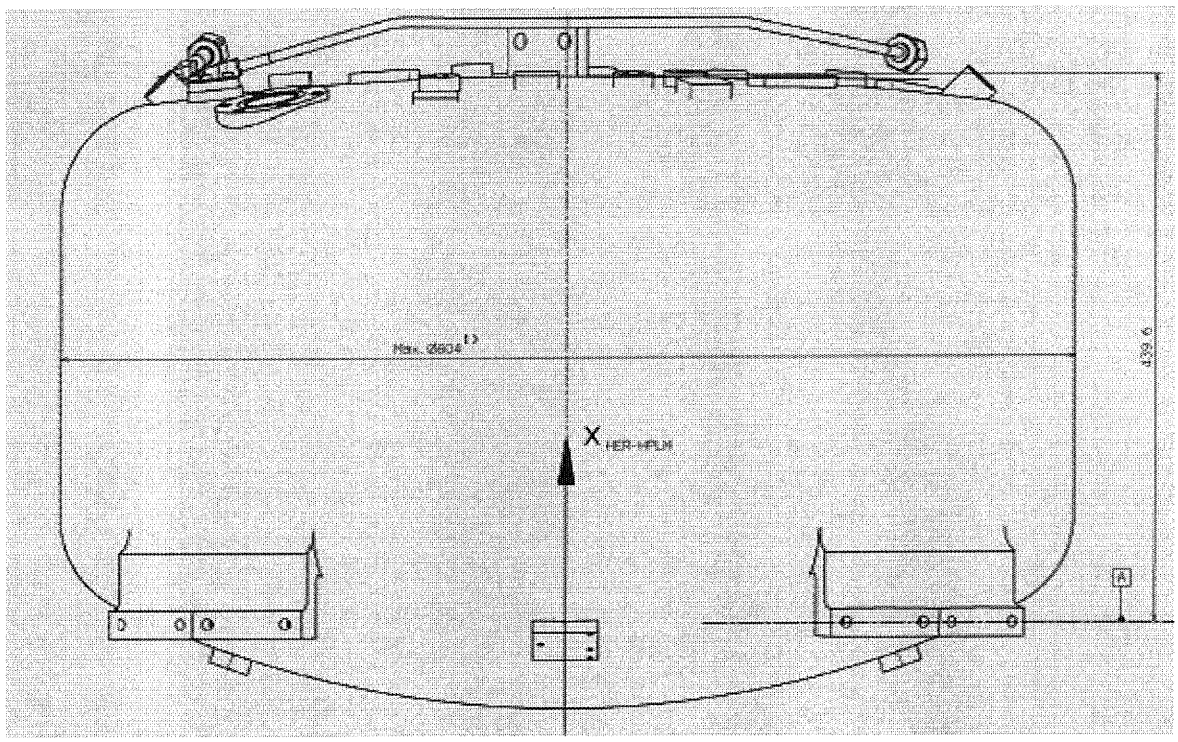


Figure 4-10: AXT basic configuration

4.7 EQM/SVM SIMULATOR

The EQM/SVM simulator is a structure to support the instrument CQM warm units (WU) during the EQM test program. The SVM simulator is a non flight item. A major step in the EQM test program is a radiated EMC test of the EQM together with the SVM simulator. To allow representative EMC predictions for the PFM, certain conformities (EMC aspects) between the EQM/SVM simulator and the PFM/SVM are requested. Basic conformities will be as follows:

- EQM/SVM simulator position in PLM X-direction identical as for PFM
- identity of the SVM structure (EMC aspects) wrt. to basic dimensions and materials tbc.
- identity of routing and fixation of the external instrument harness
- identity of configuration and routing of the waveguides
- as far as possible identity of locality of the warm units
- as far as possible identity of configuration and dimension of the warm units

Stability of the structure must allow tilting of the EQM together with the SVM and WU's during testing. Dismounting of the WU boxes during testing must be possible also if the EQM is mounted in the test dolly. Mobility of the equipped SVM simulator is requested.

Design description

The SVM simulator is a octagonal structure tbc. and consists of the following major parts:

- Two centring rings connected by a self-supporting aluminium profile structure
- 8 I/F clamps to mount the SVM simulator to the PLM
- Shear plates to ensure high rigidity of the structure
- 8 lateral panels with Aluminium face-sheets and inserts to accommodate the WU
- segmented (easiness for integration and accessibility to SVM equipment) upper closure panel to provide support for the harness and harness connector brackets
- detachable set of wheels mounted at the bottom side of the structure to move the SVM simulator without PLM

SVM simulator principle technical details and dimensions are shown in fig. tbd.

SVM simulator equipment

The following WU's are foreseen to be integrated to the SVM simulator structure:

Instrument	Warm Unit	Appr. Size [mm]	Appr. Mass
HIFI 1 (panel 1)	LSU	424*286*265	19,0 kg
	LCU (AVM)	340*290*260	15,8 kg
	HRH (AVM)	390*355*102	12,9 kg
	IFH	107*70*107	1,0 kg
	WOH	400*170*130	6,0 kg
	WEH (AVM)	290*240*176	7,2 kg
HIFI 2 (panel 2)	ICU	274*258*194	8,0 kg
	FCU	326*289*180	8,9 kg
SPIRE (panel 3)	DPU	274*258*194	7,2 kg
	FCU (QM1)	332*300*315	16,3 kg (tbc)
	DCU (QM1)	491*300*315	14,4 kg (tbc)
PACS (panel 4)	DECMEC (AVM)	400*270*120	23,0 kg (tbc)
	DPU	240*258*194	6,6 kg
	SPU (AVM)	280*240*350	7,0 kg (tbc)
	BOLC (QM1)	328*300*314	15,3 kg (tbc)
	Power Supply Unit (2x)	TBD	TBD

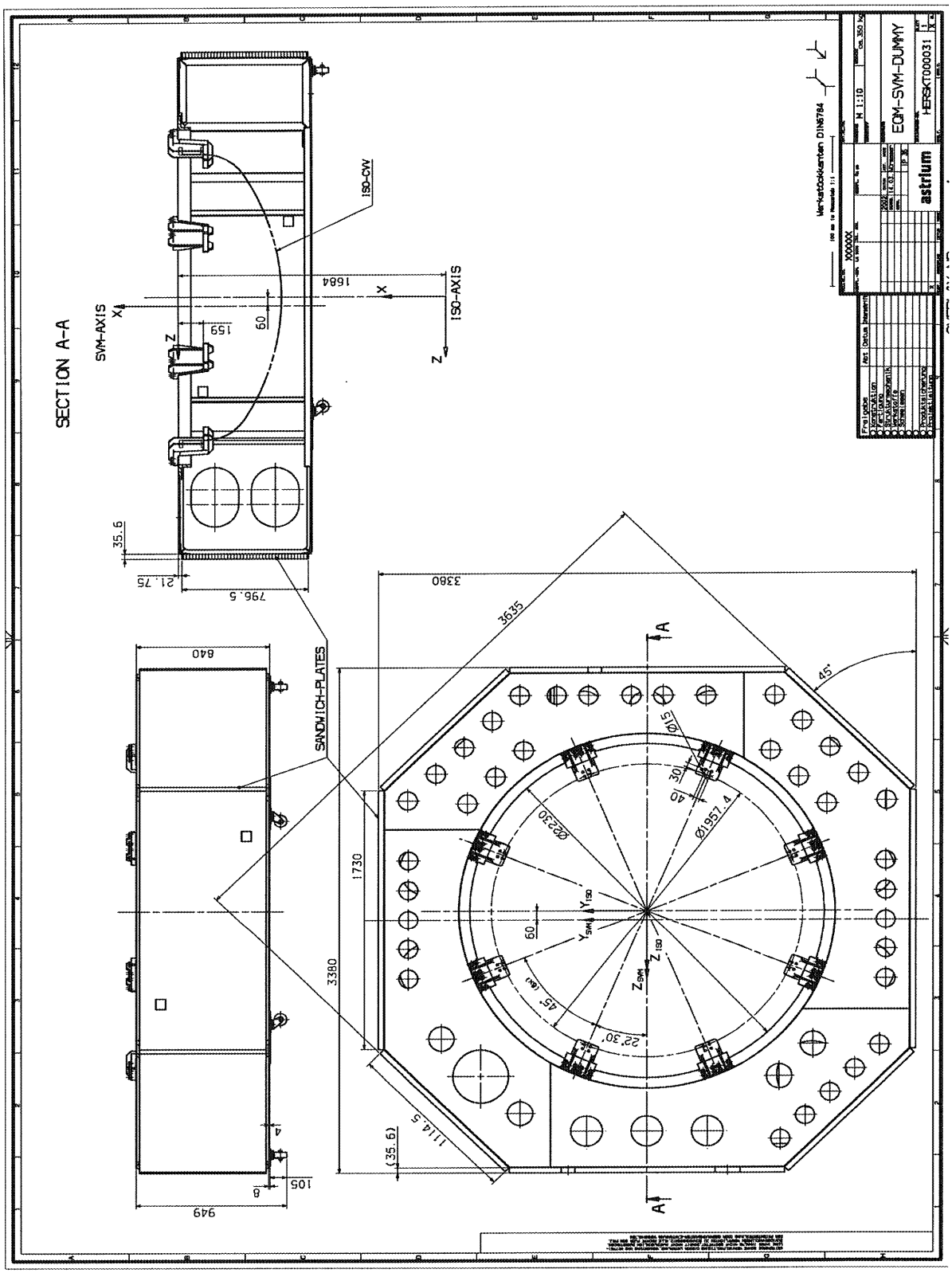


Figure 4-11: Preliminary design for EQM/SVM simulator

5 INTEGRATION AND TEST PHILOSOPHY

5.1 INTEGRATION

5.1.1 PRE- INTEGRATION INSPECTION AND H/W RELEASE

Before starting the integration an incoming inspection will be performed on each delivered equipment to control the quality of the hardware to be integrated.

As a minimum, the following controls/measurements will be performed:

- control of data package according to the shipping list
- visual inspection
- cleanliness inspection
- conformity of identification markings and serial numbers to the configuration status
- fit check (if possible) dimensional check and planarity
- mass
- instrument health check after shipment

Release of hardware for integration will be controlled. Parts required for a particular integration activity will be kited to reflect the requirements of the governing procedure prior to the need date. This kiting operation shall include an inspection according to the system/module assembly drawing and subsystem manufacturing drawings to ensure that all parts materials are available and that obvious anomalies are found prior to the beginning of integration activities.

5.1.2 MECHANICAL INTEGRATION/DISASSEMBLY

Mechanical integration/deintegration will be performed according integration/deintegration procedures in step by step format. All activities will be given in correct timely order.

All de-integration and re-integration activities of the open EQM cryostat will be performed in clean room class 100 environment.

The handling- and integration activities of EQM hardware will be carried out using mainly the ISO refurbished MGSE. It will be done by trained authorised personnel with the necessary experience (ISO heritage).

The deintegration and storage of Herschel relevant H/W from ISO must be performed such that they can be reused for Herschel PLM/EQM (e. g. protection of flange I/F's is mandatory). Generally all parts which show anomalies (e.g. helicoil inserts, gaskets) have to be replaced. Clear marking of dismounted parts is requested for precise identification during reintegration phase.

Major steps of the PLM EQM integration are:

- Disassembly of ISO components not used further on
- He S/S tubing re-routing/completion
- Integration of new auxiliary tank and L0 cooling struts
- Re-routing of CCH

- Closure PLM lower part
- Closure of cryostat for training phase with temporary installed items
- -OB template
  -Cover plate
  -CVV connector ring with blind flanged vacuum connector feedthrougs
- Evacuation and leaktest
- Move PLM in cleanroom class 100 000 into test dolly
- *Training phase*
  - Connection of cryo. SCOE
  -SFT warm
  -Cool down and filling; adjustment strap of strap pretension
  -SFT cold
  -He II production AXT
  -SFT He II conditions
- *End of training phase*
- Move PLM in clean room cl. 100 integration dolly
- Open cryostat upper part
- Deintegrate temporary installed items
- Integration of AXT LO struts
- Integration of OBA
- Connection of optical bench ventline
- Preintegration of CCH and SIH
- Integration of intermediate thermal shields
- Integration of connector ring
- Continue CCH and SIH integration (vacuum feedthrough connectors in intermediate ring)
- Integration of FPU's and connecting of L0 and L1 cooling straps
- Final integration of instrument harness
- Alignment of HIFI (OBA) w.r.t. CVV windows
- Integration of OBA shield and instrumentation
- Closure of CVV upper part (thermal shields, upper bulkhead and filling port)
- Integration of LOU
- Alignment LOU vs. HIFI
- Integration of cryo. cover
- Installation of vacuum pumps
- Evacuation and leak test
- Transport to clean room 100 000 into test dolly

The re-integration will be completed after closure of the cryostat with a successfully performed leak tightness test. The final integration activities will be continued in clean room class 100.000 (e.g. waveguide integration, external harness integration ...)

5.1.3 HARDWARE AS BUILT STATUS" LIST

Through an official record the hardware "as built status" shall be traced during the AIT activities. The record shall state:

- drawings
- integrated hardware part and serial number
- integration date
- module
- subsystems
- integration location, (if applicable)
- grounding measurement result (if applicable)

5.1.4 CRITICAL INTERFACES

All sensitive interfaces (sensitive flange- or optical I/F's.) must be adequate protected e.g. by foil or protection covers

5.1.5 ELECTRICAL INTEGRATION/DEINTEGRATION

The general approach is a sequential assembling and testing. Each unit shall be reasonable functionally tested within existing constraints as far as possible before further units are added. The philosophy shall allow the identification of problems as clear and early as possible. Electrical integration will be supported by Integrated Data Acquisition System (IDAS).

5.1.5.1 HARNESS AND WAVEGUIDES

Harness and waveguides will be handled and installed only by adequate and authorised personnel. All harness interfaces have to be protected by connector savers during integration. Mating/demating during ground handling will be made by separating "non flight" hardware interfaces. Electrical integration of harness will be completed by execution of detailed functional checks/tests. Open ends of the waveguides will be protected by adequate caps.
For deintegration of ISO harness cables to be modified it will be preferable to detach cables at a suitable I/F before cutting cables.

5.1.5.2 INSTRUMENT COLD UNITS INTEGRATION

Grounding and precaution of static discharge requirements will be verified before any activity. Electronic unit/box connectors will be protected by connector savers during integration.

The instrument cold units integration will be supported by short electrical interface checks performed with adequate instrument unit tester.
For more details refer to RD 04 chapter 7.10 which defines the specific procedures and precautions which will be considered during the instrument integration

5.1.5.3 INSTRUMENT WARM UNITS INTEGRATION

Grounding and precaution of static discharge requirements will be verified before any activity.
Electronic unit/box connectors will be protected by connector savers during integration.
Mating/demating during ground handling will be made by disconnecting "non flight" hardware interfaces.

Electrical integration of units and subsystems will be completed by execution of detailed functional checks/tests.
The instrument warm-units will be integrated onto the SVM platforms in parallel to the cryostat integration as offline activity in cleanroom class 100.000. The warm-unit integration will be completed by a test sequence debugging, using the FPU simulators as far as available and the PLM EGSE together with the CCS light.
These pre-integrated SVM platforms will be finally installed to the cryostat prior instrument testing.

5.2 CRYO OPERATIONS

In order to allow instrument testing in the required thermal environment, the cryostat has to be cooled down and the tanks filled with LHe. Instrument cool down requirements will be respected.
Requirements for cry operations are given in the He S/S specification RD10.

5.2.1 COOLDOWN & FILLING

The cooldown and filling will be performed according procedures, based on the verified ISO documents and using the refurbished ISO CVSE.

Cooldown and filling will start after successfully performed leaktest of the internal Helium S/S to the cryostat isolation vacuum and isolation vacuum to ambient. After filling of the main tank with LHe I, a cold leaktest will be performed.

Similar procedures will be used for filling the auxiliary tank with LHe I.

Cooldown and filling will be performed in vertical position only.

5.2.2 HELIUM II PRODUCTION & TOP UP

The Helium II production and top up will be performed according procedures based, on the verified ISO documents and using the refurbished ISO CVSE.

According our EQM design concept of the cryostat, the auxiliary tank will be used as He II reservoir for instrument testing, venting through the optical bench directly out of the CVV to the Helium pumping units. It provides the required level 0 temperatures as well as the level 1 and level 2 temperatures, by adjusting the required flight representative massflow of approximately 2.2 mg/s.

These conditions have to be maintained during the complete test sequence. Refilling of the auxiliary tank will start latest at a liquid level of 10 %.

He II production and top up will be performed in vertical position only.

5.2.3 CRYO COVER OPERATION

To provide active cooling of the internal CC components cover flushing with LHe can be performed. For this purpose a dedicated LHe transferline from a external dewar and an adequate venting line have to be connected to the CC Johnsten coupling I/F's.

Testing with the EQM cryostat will be performed with x-axis in vertical position, some tests (e.g. cooler recycling) by tilting of cryostat around z-axis.

Cover flushing will be performed according dedicated procedure.

No cover flushing during training phase. For training phase cryostat cover replaced by Cover Closing plate without active cooling feature

5.2.4 DEPLETION & WARM-UP

The depletion and warm-up will be performed according procedures based, on the verified ISO documents and using the refurbished ISO CVSE.

It will start after finalising the instrument testing. It will be performed using the internal heaters of the main tank and auxiliary tank.

5.3 EQM TESTS

5.3.1 INSTRUMENT TESTS

The main objective of the instrument test program is to verify the mechanical, electrical, electromagnetic and thermal compatibility of the instruments with the EPLM in flight representative cryogenic conditions.

According PLM EQM activity flow see Fig. tbd the following instrument specific tests are foreseen as follows:

5.3.1.1 SHORT FUNCTIONAL TESTS (SFT).

The principle objective of the SFT is the check of the electrical integrity and operability (command and control) of the EPLM. The SFT does not require any specific EPLM configuration/condition (e. g. cryostat orientation) or specific instrument GSE. The test duration is in the range of 1 hour per instrument. Three different types of SFT's exist, one per the major tank temperature conditions:

- SFT warm (tank without helium)
- SFT cold He1 (AXT with normal fluid helium)
- SFT cold He2 (AXT with supra fluid helium).

5.3.1.2 INTEGRATED MODULE TEST (IMT)

The superior objective of the IMT is the verification of the correct operation of the fully integrated EPLM in a series of representative mission modes. This includes the verification of the functional performance of the integrated instruments and their measurement performance, as far as it is possible on that level. On PLM EQM level only one IMT is planned. During the IMT the constraints of the PLM tilting angle during PACS and SPIRE cooler recycles will be considered.

The IMT includes the verification of the hold time of the 300 mK cooler, i. e. in the IMT a full cooler recycle period is foreseen for PACS and SPIRE

5.3.1.3 EMC TEST

Because of limited representativity of the AVM primary power interfaces and the unavailability of the PCDU it shall be ~~rererred~~ referred to the CE/CS performance as measured during the instruments test programmes of PACS, SPIRE and HIFI.
Instead, and in accordance to customer request an RS test will be performed. This will be done in a standard integration facility (no anechoic chamber).
As far as possible absorber walls shall be installed, at least however at the opposite side of the radiating antenna as well as behind the antenna in order to minimize effects of standing waves.

The CVV will be connected to the Helium pumping units via large tubes. For a limited time these units might be switched OFF, the mechanical connection however cannot be cut.
The wiring between the PLM and the EGSE shall be specifically shielded with Al foil (to be integrated before start of test).
The PLM shall be in operational mode. In any case the equipment shall be operated to be sensitive. Performance checks shall be performed as usual. In case of susceptibility, the susceptibility threshold shall be predicted. The details for the prediction of the susceptibility threshold shall be clarified with the manufacturer of the equipment which has failed.
The following table summarizes the EMC tests performed within the Herschel programme (EQM and PFM):

	CE	CS	RE-H	RS-H	RE-E	RS-E
Equipment level	Y	Y	N	N	N	N
EQM	not possible	N	N	Y	N	Y
H-EPLM FM	Y	N	N	N	N	N
S/C FM	Y	N	N	Y	Y	Y

Table 5-1: List of EMC tests

5.3.1.4 SPECIFIC PERFORMANCE TEST (SPT)

Objective of the SPT is to verify dedicated aspects of the instruments performance. This may require a specific spacecraft configuration.

I. e. SPT's are a tools to verify the instrument performance on EPLM level. The tests are strongly based on the instrument level tests in order to allow a quick and reliable performance assessment by comparing the EPLM level test results with the instrument level test results (no degradation with respect to instrument level test results, assuming that the environmental conditions are similar).

The SPT's will be conducted with in-orbit representative thermal conditions inside the cryostat and as regards the detector back ground. This will be achieved by specific cryogenic means (e. g. cryo. cover as described in RD 2).

5.3.1.5 INSTRUMENT EGSE VALIDATION

Its objective is to check the proper electrical instrument EGSE – CCS connections and the correct functioning of the instrument EGSE – CCS interface drivers.

The Instrument EGSE validation will comprise a stand-alone test of the Instrument EGSE (self-test).

Secondly, after connection to the CCS lite, an interface check will be performed (PIPE protocol).

5.3.1.6 INSTRUMENT INCOMING INSPECTION

Incoming inspection comprises the following activities:

- Visual inspection of the instrument for damage.
- Check of completeness of hardware items and documentation

Objective and definition of each test is given in "Instrument Testing on PLM EQM Level" RD04.

Some of these tests will be supported by tilting the cryostat around z-axis according instrument or cryostat needs. The release for starting the test will be given by a TRR. Instrument testing will be performed only according dedicated procedures. A test report will be issued after test.

5.3.2 ALIGNMENT PROCEDURE VERIFICATION

PLM Alignment procedure validation will be performed as far as possible with the FPU MTD during PFM qualification and test phase.

5.3.2.1 PLM EQM ALIGNMENT

PLM EQM alignment will be performed as requested for instrument alignment with standard alignment equipment as e. g. theodolites, linear measurement device (LMD) tbc. The rotary table is not available for the EQM, he is in use for alignment activities within the PFM programme.
Alignment activities are limited to alignment of FPU's wrt. OBA and HIFI-FPU wrt. LOU (tbc).

5.4 TEST SET UP

On the following pages major PLM /EQM test set up's are shown:

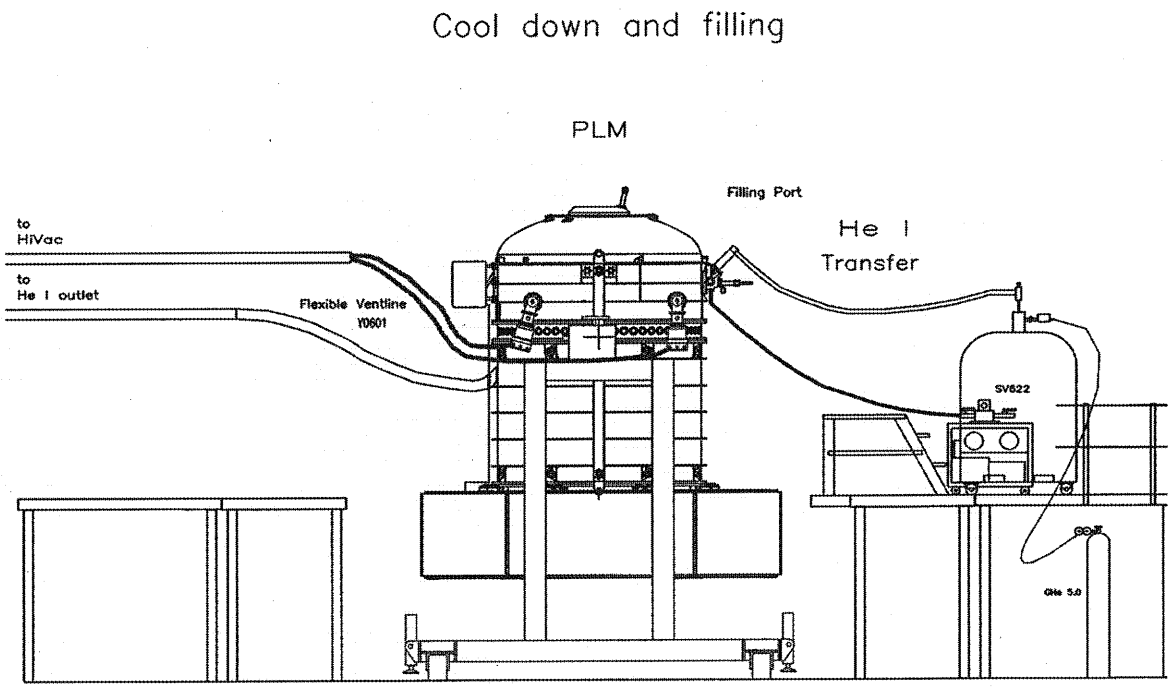


Figure 5-1: PLM set up for cool down and filling and cold instrument testing

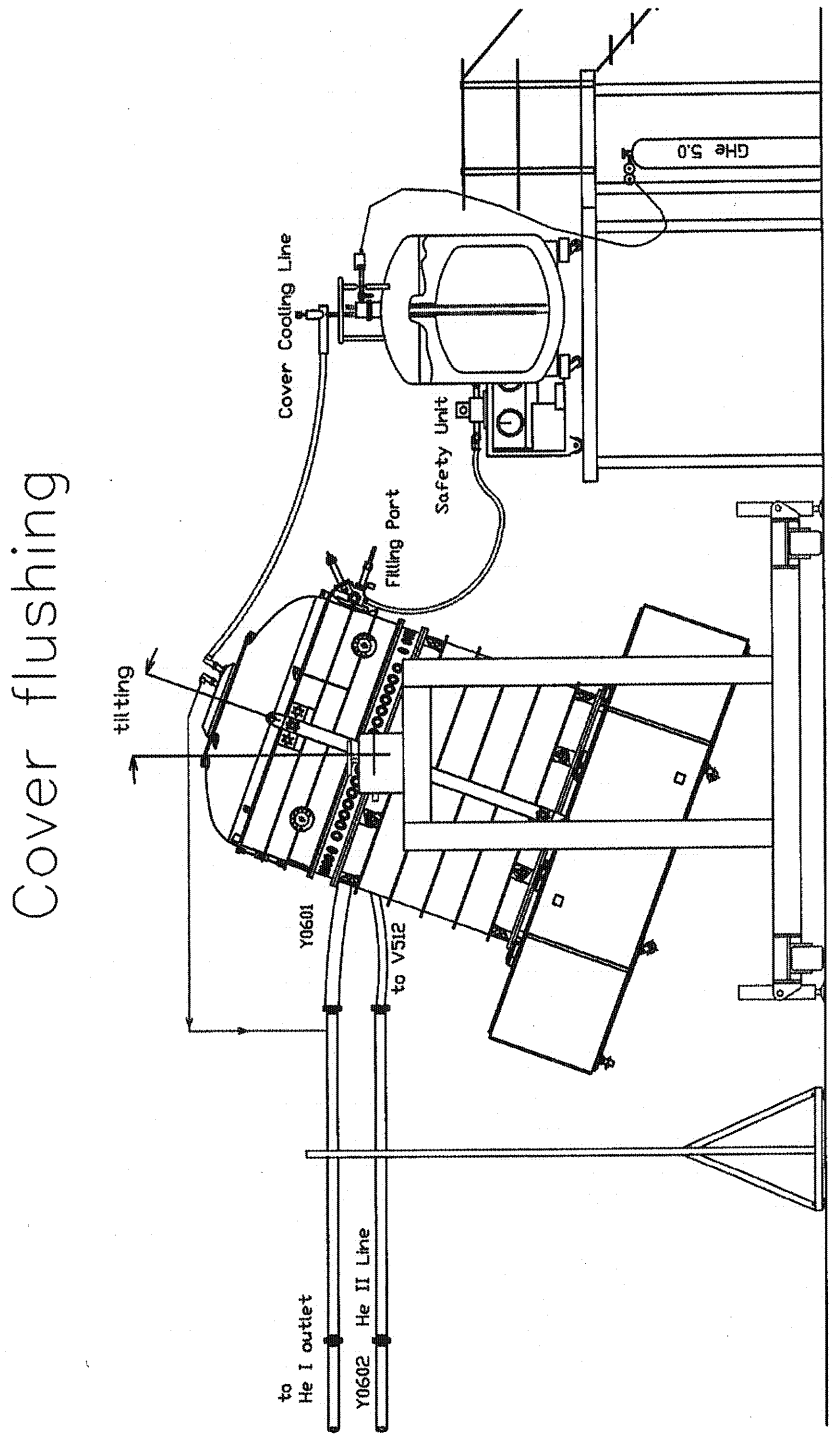


Figure 5-2: PLM set up for cold instrument testing

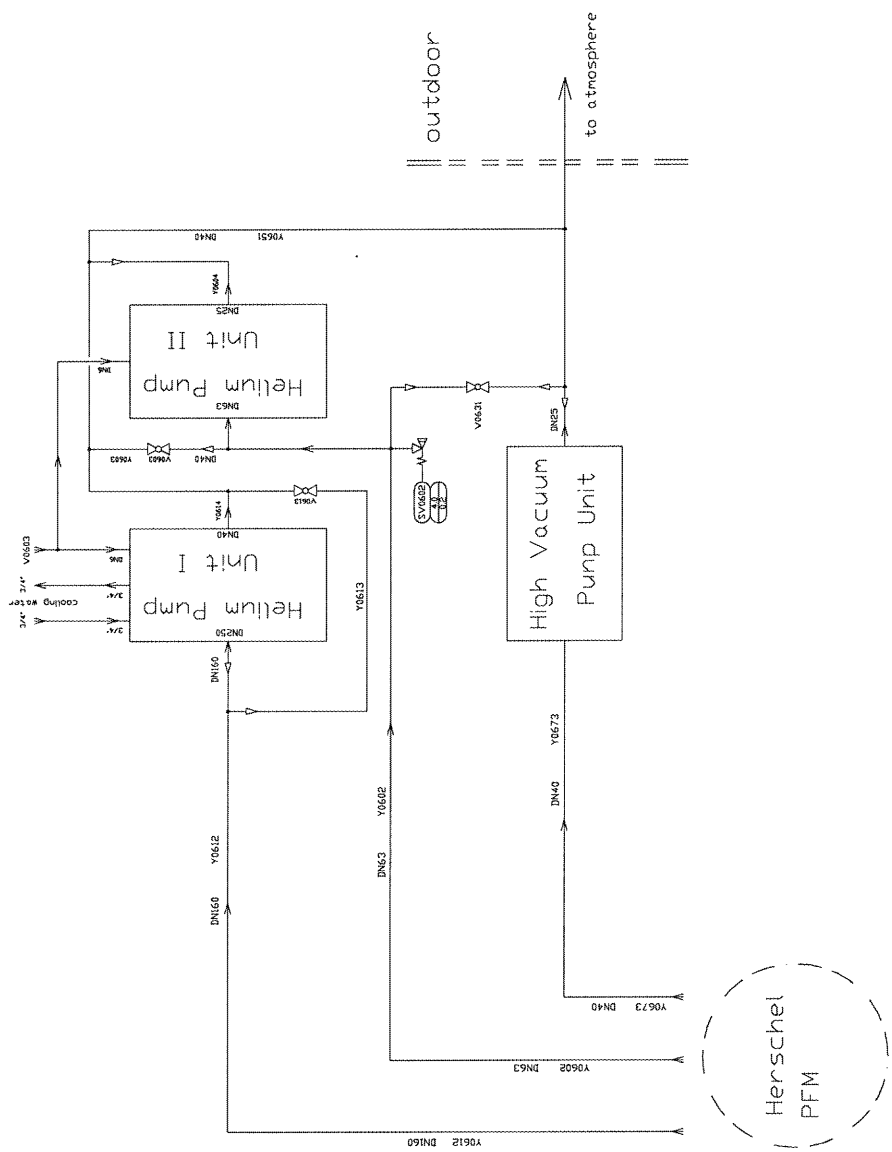


Figure 5-3: Arrangement of cryogenic servicing equipment

5.4.1 PRINICPEL EGSE SET-UP

The principle PLM EQM test set-up is shown in figure 15. It consists of the EPLM EQM equipped with the 3 instrument FPU CQM's and a SVM simulator structure with the integrated instrument warm units AVM's and the EGSE. The EGSE consist of CCS "light" and the PLM EGSE with data- and power front ends which provide flight representative interfaces to the instruments, the Cryo SCOE to control the cryostat and the Instrument EGSE. The Instrument EGSE consists of 1 nominal EGSE and 1 back-up EGSE. The Instrument EGSE is common for all instruments.

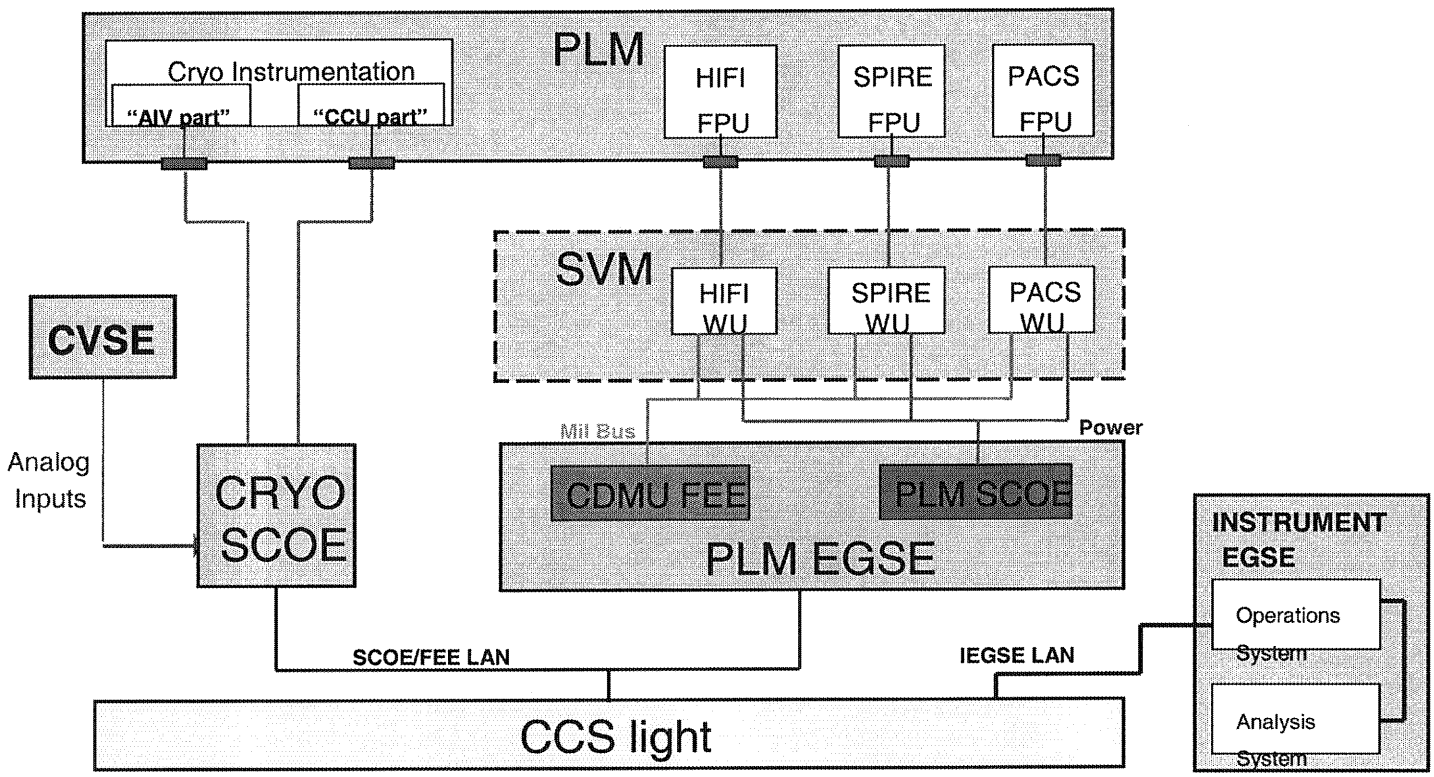


Figure 5-4: Principle EGSE set up for instrument testing

5.4.2 EMC SET-UP

The RS test will be performed in the standard integration facility. In order to minimize interferences from neighbored facility, the clearance between the PLM and the facility shall be at least 2 m (see also Figure 5-5 below). As far as possible absorber walls shall be installed, at least however at the opposite side of the radiating antenna as well as behind the antenna in order to minimize effects of standing waves.

The PLM EQM will be equipped with the SVM Simulator fully loaded with the avionics modules, whereas the PLM PFM will be used with the SVM FM.

The CVV will be connected to the Helium pumping units via large tubes. For a limited time these units might be switched OFF, the mechanical connection however cannot be cut.

The use of break-out boxes is not permitted because they would allow the RS noise to enter the equipment.

The wiring between the PLM and the EGSE shall be specifically shielded with Al foil (to be integrated before start of test).

The test antennas shall be placed at TBD positions directed to the PLM openings and the harness.

Details of the EMC set-up are described in the EMC test plan HP-2-ASED-PL-0037.

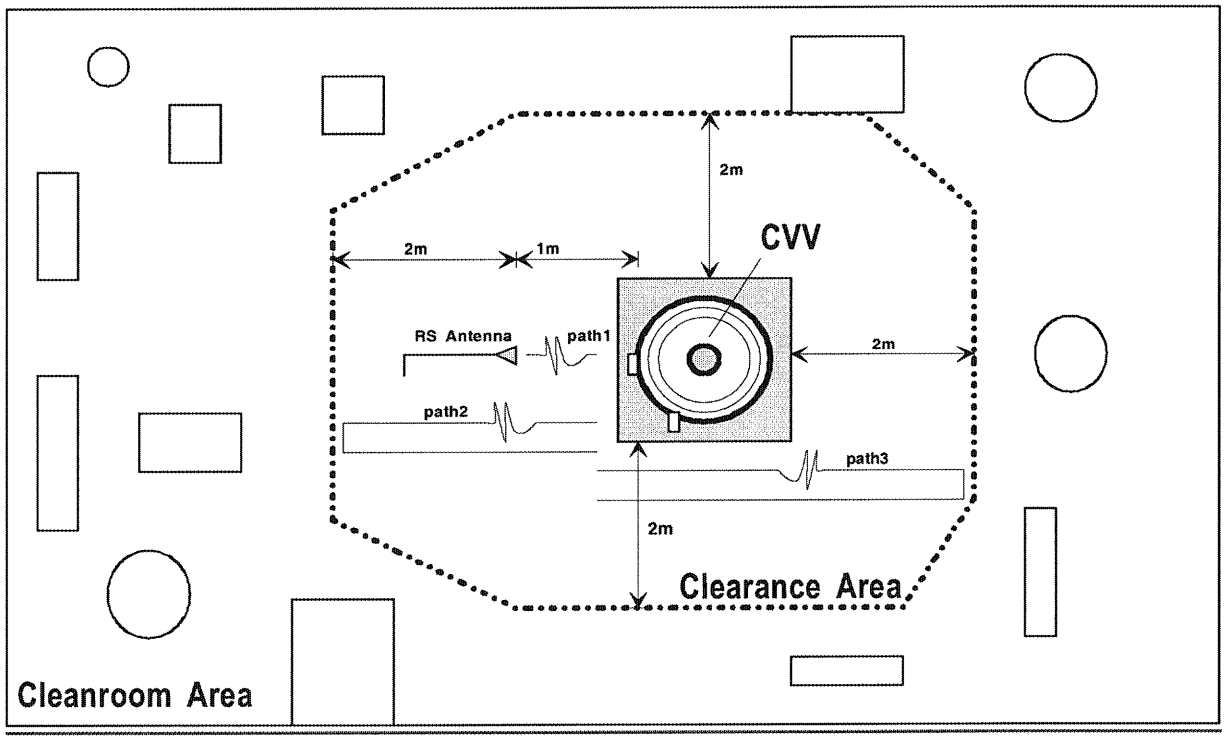


Figure 5-5: Set-up for EMC test

5.5 AIT LOGIC FLOW

Logic flow for Herschel PLM/EQM AIT activities

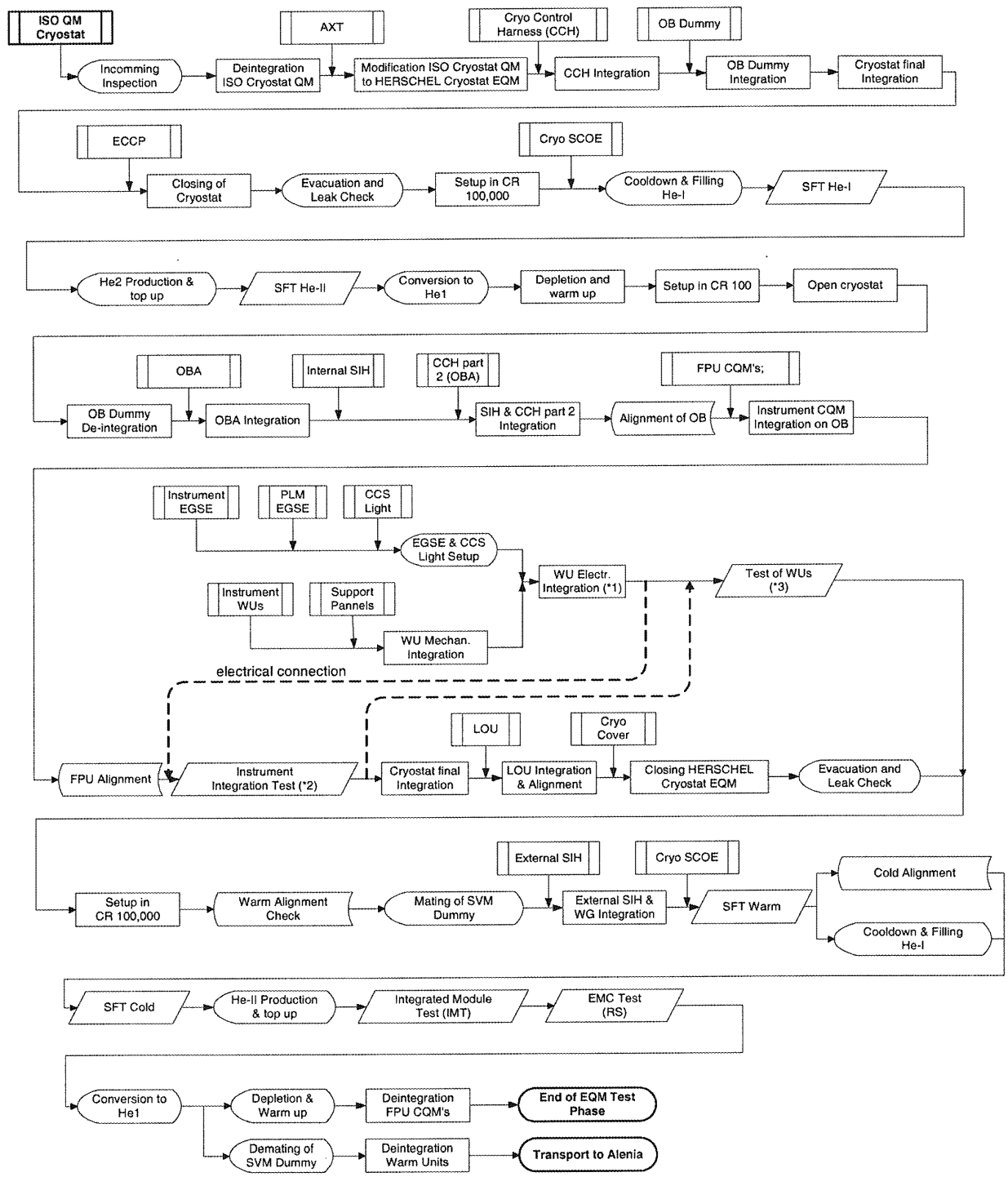


Figure 5-6: EQM AIT Logic flow

*1) Instrument specific tasks (all offline)

PACS:

- WU harness interconnection (from PACS)
- Connection of WU **with FPU CQM** (before PACS CQM FPU integration on OB)
- Connection of WU with PACS EGSE
- PACS bench test

HIFI:

- WU harness interconnection (from HIFI)
- Connection of WU with **FPU Simulator** (via HIFI harness)
- Connection of WU with HIFI EGSE
- HIFI bench test

SPIRE:

No bench test (tbc)

*2) ASED specific tasks (supported by instruments)

PACS:

- WU harness interconnection (from PACS) already done
- Connection of WU **with FPU CQM** integrated on OBA via SIH
- Connection of WU with PACS EGSE
- PACS instrument integration test

HIFI:

- WU harness interconnection (from HIFI) already done
- Connection of WU **with FPU CQM** integrated on OBA via SIH
- Connection of WU with HIFI EGSE
- HIFI bench test

SPIRE:

- WU harness interconnection (from SPIRE) already done
- Connection of WU **with FPU CQM** integrated integration on OBA via SIH
- Connection of WU with SPIRE EGSE
- SPIRE instrument integration test

*3) ASED specific tasks (supported by instruments)

PACS:

- WU harness interconnection (from PACS) already done
- Integration of WU with PLM EGSE inclusive I/F verification (by IDAS)
- PACS WU functional check
- Disconnection of WU from PLM EGSE

HIFI:

- WU harness interconnection (from HIFI) already done
- Connection of WU with FPU simulator

- Integration of WU with PLM EGSE inclusive I/F verification (by IDAS)
- HIFI WU functional check
- Disconnection from FPU simulator/PLM EGSE

SPIRE:

- WU harness interconnection (from SPIRE) already done
- Integration of WU with PLM EGSE inclusive I/F verification (by IDAS)
- SPIRE WU functional check
- Disconnection of WU from PLM EGSE

6 ORGANISATION AND MANAGEMENT

6.1 AIT TASKS

The main tasks to be performed under the AIT organisation are the following:

- detailed planning of AIT activities
- definition and sequencing of tests
- preparation of integration and test
- co-ordination and preparation of test facilities
- preparation of test set-up
- organisation of test reviews
- execution of AIT operations
- reporting of AIT operations
- determination and on site management of AIT team and technical support.

In order to fulfil these tasks, the following general rules have to be respected:

Prior to the start of any integration or test activity:

- KIP/MIP or TRR has to be held
- relevant procedures are available, reviewed and approved
- test configuration is defined, established and verified by Product Assurance
- necessary GSE, test instrumentation and facility is available and accepted for use
- safe working conditions for personnel and hardware have been established and verified by safety
- designated personnel is specially distinguished in the integration and test area

During any integration and test activity:

- all activities proceed according to approved procedures only
- anomalies or discrepancies with the procedure shall be reflected in a non-conformance report immediately raised

Conclusion of integration or test activity:

- all activities are successfully completed
- declaration sheets to verify completion are signed by the responsible engineers
- appropriate action is taken on all non-conformance reports raised during the activity
- an integration or test report is issued within an adequate time interval

6.2 AIT PERSONNEL

The AIT team will be recruited of a member of people from different disciplines. The team will be sized according to the manpower required during the various integration and test steps.

An AIT manager will be responsible for the overall co-ordination of the team. A second team member is responsible for all payload (instrument) relevant interfaces/aspects. The team will be completed by mechanics, responsible for all mechanical activities.

Only trained personnel, familiar with special requirements of class 100000/100 clean-rooms will work with the various H/W.

The AIT team will be supported as appropriate by optical engineering, mechanical engineering, thermal engineering and various supports from manufacturing departments. The necessary engineering support from the different disciplines will be provided according to the AIT program requirements.

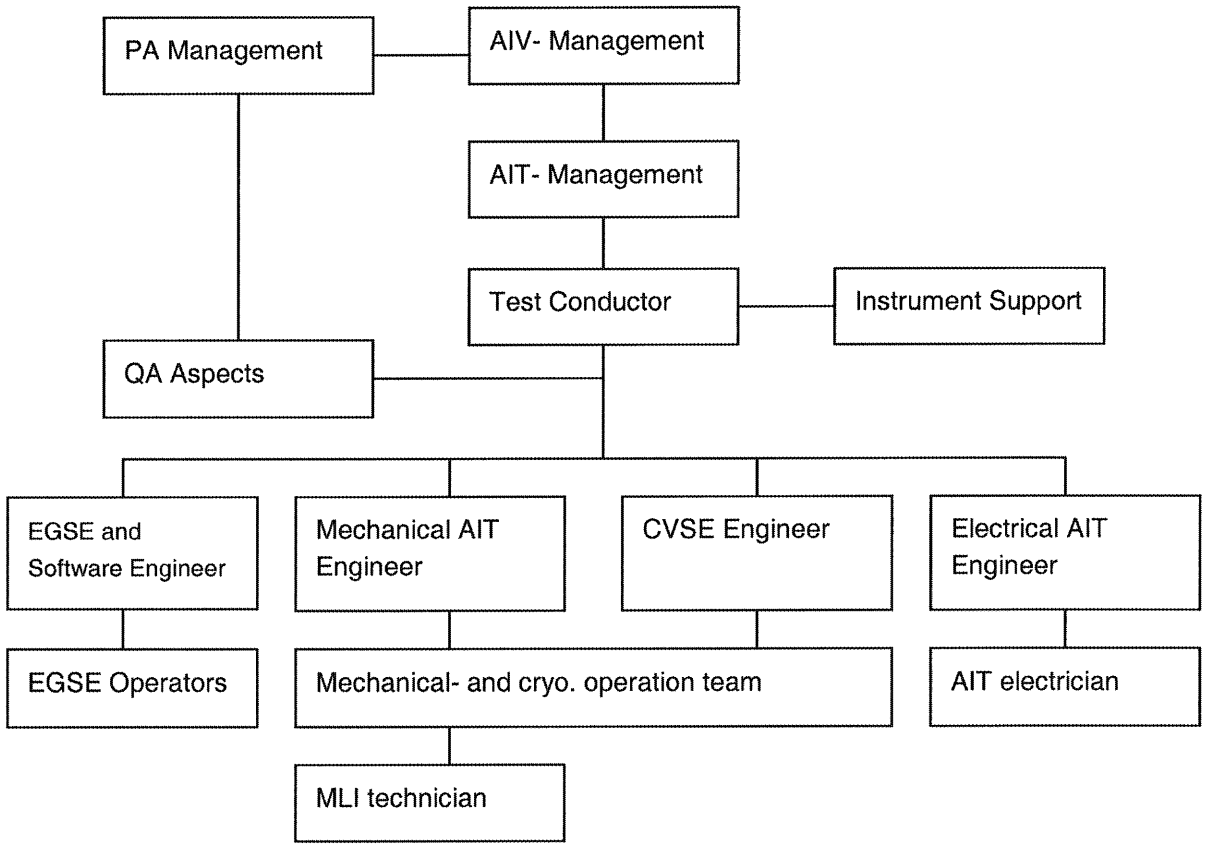


Figure 6-1: AIT Team Organisation

6.3 AIT MEETINGS AND REVIEWS

In the following a short overview of meetings and their objectives is provided:

6.3.1 AIT INTERNAL MEETINGS

Regular internal meetings will accompany the AIT process at the contractor. The meetings are used to discuss the status of AIT, further AIT activities with the corresponding members of the engineering team and PA.

6.3.2 TEST READINESS REVIEW (TRR)

The test readiness reviews have to be held in order to confirm that all documentation, hardware and facility requirements are fulfilled for a specific test. This will ensure a successful performance of the envisaged test. Test readiness reviews are announced at a suitable period prior to begin of all tests as defined in chapter 5.3.1

6.3.3 POST TEST REVIEW (PTR)

This review is to confirm that the corresponding test was performed according to the applicable test procedure, to review the result and to release the hardware configuration for the next step.

6.3.4 NON CONFORMANCE REVIEW BOARD

A review board will be established if non-conformances within integration or test program are encountered. This board has to decide upon corrective actions to be taken and therefore defines how to proceed in the program.

Further reviews, as the Qualification Review and Delivery Review Board (DRB) are no AIT specific reviews, however corresponding inputs will be delivered from AIT.

6.3.5 TEST SPECIFICATION

For the Integrated Module Test and the EMC-Test test specifications will be issued.

6.4 KIP/MIP

KIP/MIP's will be implemented in accordance with the PA plan (AD 09). The following KIP's and MIP's are planned:

- KIP 1: before integration of AXT
- KIP 2: before instrument FPU's integration on OBA
- KIP 3: before instrument alignment

- MIP 1: before start modification of ISO cryostat QM to Herschel cryostat EQM
- MIP 2: before final closure of cryostat (cryo cover integration)

6.5 INTEGRATION/TEST PROCEDURES

The integration and test documentation comprises different types of documents:

- documents used for definition of AIT activities:
  AIT plan and other applicable documents called therein
- documents used for performing the AIT activities defined above:
  instructions, integration/test procedures
- documents used for reporting AIT activities:
  test reports
- documents for controlling the AIT:
  log books and AIT forms

6.5.1 INSTRUCTION-/INTEGRATION-/TEST PROCEDURE

To be in compliance with required degree of quality, only units and assemblies will be assembled and integrated which have successfully passed a formal qualification or acceptance test/inspection program. A certificate of compliance duly accepted and contained within the data package is required.

Integration- and Test Procedures will be written for major AIT activities. This documentation will provide detailed step-by-step instructions to the dedicated teams conducting these activities.

This documentation shall contain the following information:

General view:

- Describing the activity objective, item to be handled, references, methods and success criteria.
- List of applicable and reference documents.
- Facilities description, listing of GSE items, tooling required personnel functions and other equipment.

Instructions:

- Provision of general set-up instructions including cleanliness and safety, environmental conditions, hazards and precautions.
- Step-by-step operation sequences, including an operational flow diagram where required:

  In this section all measurements will be recorded against the required schedule, including check out sequences to be executed in case of test configurations (description of activity set-up) and pass/fail criteria.

Documentation and data sheets:

Identification of test result data delivered by the corresponding GSE. Data sheets to be prepared by the operator.

6.5.2 TEST REPORT

For each test, a test report containing the actually performed operations and the detailed test results shall be generated.

The test report starts as soon as the test itself is running. As the test proceeds the information, documents, lists, data sheets, records etc. are incorporated in the corresponding sections up to the test completion. Finalising the test report require to analyse the results with respect to success criteria and to draw the test conclusion.

The major sections of the test report are as follows:

- Filled in/as run procedure including performed operations, test date, applicable documents, test conclusion
- Test results including detailed results and analysis where applicable
- Configuration status w.r.t. specimen configuration during operation, GSE configuration, test set-up
- NCR status including a list of non-conformances issued during operations
- Time record, which lists the actual operation sequence. Raw data sheets if applicable like log sheets, minutes, data recording
- Procedure Variation Sheet

6.5.3 AIT FORMS

Log documentation:

A logbook will be established at the beginning of AIT activities and will be maintained up to date until delivery. Log sheets will be used to document all planned and unplanned events, supporting documentation will be added as necessary. In addition, a configuration list will be kept current to reflect the as-built status at any point of time.

The logbook will provide a complete traceability for the instrument. The logbook will finally be incorporated into the Acceptance Data Package.

AIT change request (CR)

The CR is the only authorised way to improve or modify an integration/test procedure when competent authority has already approved this one and there is not enough time to prepare a new issue. All changes will be justified and agreed prior to the event. CR´s will be approved at the same authority level in the organisation as it is the case for the integration/test procedure.

The CR has to identify following issues:

- adding a new task

  The corresponding test sequence (step-by-step section) shall be included into the CR file with clear definition sequencing

- suppressing a planned task

  The CR shall clearly identify the test sequence of the current procedure to be cancelled.

- modifying a task already clearly defined

The CR shall include the new issue of the test sequence to be updated.

The CR can be the consequence of:

- change in test specification/plan
- calculation, prediction analysis, thermal or mechanical models processing etc.
- analysis of preliminary result (coming form another test or processed during the test itself)
- unavailability of unit, test equipment, facility etc.
- unexpected limitation in capability of test equipment or test facilities
- non conformance and failure.

The CR modifies an integration/test procedure and after agreement it becomes a part of this one, so the CR does not justify issuing a specific test report, but it will be automatically included in the test report of the corresponding procedure.

Non-conformance reporting and control will be performed on any article or material which fails to meet the requirements of the contract as interpreted through drawings, technical specifications and integration/test procedures.

6.6 QUALITY ASSURANCE

Quality assurance will be actively involved during assembly, integration and test to ensure that all activities are performed in a controlled manner and documented in accordance with corresponding PA plan (AD 09) .

The main AIT QA tasks will comprise:

- assurance that all activities are performed in accordance with released procedures
- surveillance of activities
- recording of the ABCL
- surveillance of environmental conditions (temperature, humidity, cleanliness)
- verification of calibration validity of measurement equipment
- correct application of the non-conformance reporting system
- performance of inspections
- perform MIP/KIP
- For more details concerning the QA tasks reference is made to the PA plan

7 CLEANLINESS AND CONTAMINATION CONTROL

7.1 SCOPE

The detailed requirements on cleanliness and contamination control for Herschel E-PLM AIT are comprised in the Contamination Control Plan.

This chapter of the document describes only the major relevant requirements to be respected during Herschel E-PLM AIT. Details are included in a.m. document which is a subdocument to this document refer to AD 08.

7.2 CLEANLINESS REQUIREMENTS

Cleaning/Cleanliness inspection for any H/W entering the clean cabin cl. 100 is **mandatory.** For more details refer to AD08 Cleanliness contamination control plan

7.3 CLEANLINESS MONITORING ACTIVITIES

The following paragraphs list some of the cleanliness control measurements which are suitable and shall be implemented in an appropriate manner.

Standard-Cleanliness Monitoring

Particulate and molecular cleanliness monitoring shall be performed during all phases of AIT, starting from the point of arrival of the hardware at the instrument contractors AIT site until launch.

Witness Samples

Witness samples have to accompany cleanliness sensitive surfaces and components. Samples have to be located close to critical surfaces or surfaces which are representative w.r.t. overall contamination.

The witness samples have to be exchanged periodically in certain time intervals according to CCP (AD 08).The samples will be tested by special laboratories w.r.t. particular and molecular contamination.

7.4 SPECIAL PROTECTIONS TO PREVENT CONTAMINATION

If special protections are foreseen to prevent contamination on the sensitive Optic and components they shall be respected and implemented for the detailed planning of AIT procedures with high priority.

8 FACILITIES AND TRANSPORT

8.1 MAJOR FACILITIES USED FOR HERSCHEL PLM EQM AIT

The Herschel PLM EQM specific requirements on facilities will be specified by the AIV management. Product Assurance will be involved in the acceptance of new facilities. The main facilities used within the Herschel PLM EQM AIT program are:

- class 100 clean room used for alignment and mechanical integration of the PLM
- Clean room class 100.000 used for preintegration of H/W (functional testing), incoming inspection of components, provision and cleanliness inspection of PLM H/W.

The facilities are standard for AIT of optical space instruments. All facilities have to be accepted for use by PA.

8.2 INTEGRATION FACILITY

The EQM integration will be performed in a class 100 clean-cabin, respectively a class 100.000 cleanroom in Astrium OTN/FN. The instrument EGSE, used for functional checks during the instrument integration, will be installed in a checkout room near the integration room.

The main dimensions and capabilities for the integration facility at Astrium OTN are as follows:

clean-room class 100.000 (acc. To US-Fed. Stand.209D)
- length 14 m
- width 20 m
- height 12 m
- door width 6 m/height 7.2 m
- max. crane load 4000 kg
- max. hook height 9.4 m
- max. floor load 1000 kg/m^2

clean-cabin class 100 (acc. to US-Fed. Stand.209D)
- length 10 m
- width 8 m
- height 7 m
- max. crane load 4000 kg
- max. hook height 6 m
- max. floor load ca. 10000 kg/m^2 (within the concrete foundation)

checkout-room (lab conditions)
- min. useable area 25 m^2

The cable length between the checkout-room and Telescope Electronics in the class 100.000 is $\leq$ 30 m.

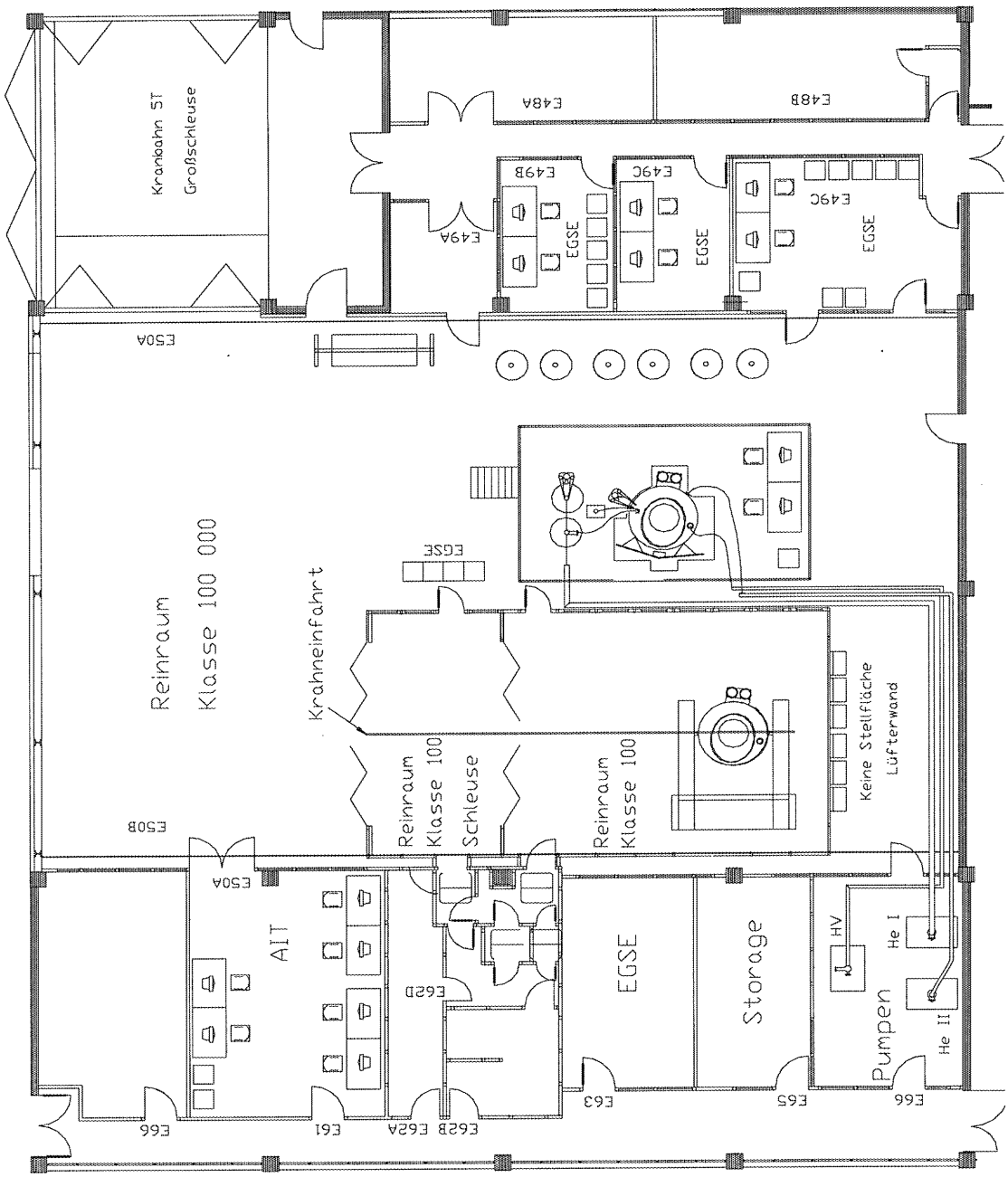


Figure 8-1: Integration facility at Astrium OTN

9 GROUND SUPPORT EQUIPMENT (GSE) IDENTIFICATION

The purpose of GSE is to support the Herschel PLM/EQM AIT activities as non flight equipment's. The GSE ensures that the function of

- integration and handling
- transportation
- optical alignment
- testing and verification

of the Herschel PLM/EQM H/W in their intended environment are fully supported and carried out easily and safely (refer also to § 13 of the PA Plan AD 09).

9.1 MECHANICAL GROUND SUPPORT EQUIPMENT (MGSE)

The following MGSE, mainly refurbished ISO MGSE, will be used:

Equipment	No.	Reference
PLM Integration dolly	1	ISO-VV-ZYYR-SP-0043
Hoisting equipment SN02	1	ISO-VV-ZYYY-SP-0048
Test dolly SN02	1	ISO-VV-ZYYX-SP-0473
Test dolly (enlarged) SN03	1	HP-2-APCO-DW-0045
Heavy duty working platform	1	-
Load cells with strap pretension gauge	16	-
ISO/SVM Support Trolley	1	-
Mobile Access Platform MAP	1	-
Instrument MGSE (e.g. instrument lifting device, transport and storage box)	-	-
OBA Hoising Device	1	HP-2- SEN-DW-5100-000
OBA Handling Device	1	HP-2- SEN-DW-5200-000
OBA Transport Container	1	HP-2- SEN-DW-5300-000

9.2 ELECTRICAL GROUND SUPPORT EQUIPMENT (EGSE)

The following Herschel PLM EQM specific electrical ground support equipment is required:

Equipment	No.	Reference
HIFI Instrument EGSE	1	PTI No. 111520
SPIRE Instrument EGSE	1	PTI No. 1125...
PACS Instrument EGSE	1	PTI No. 1135...
Central Checkout System (CCS) light	1	PTI No. 142210 (EPLM)
Cryo SCOE # tbd.	1	PTI No. 142220 (EPLM)
CDMU Front End	1	PTI No. 142230 (EPLM)
PLM SCOE	1	PTI No. 142240 (EPLM)
Test cabling	1	PTI No. 142250 (EPLM)
Diverse power supplies (standard)	-	-
Diverse brake out Boxes and Savers	-	-

9.3 CRYO VACUUM SERVICE EQUIPMENT (CVSE)

The following CVSE, mainly refurbished ISO CVSE, will be used:

Equipment	No.	Reference
Helium pumping unit 1	1	CVSE Item No. C-01-01
Helium pumping unit 2	1	CVSE Item No. C-01-02
High vacuum pumping unit	1	CVSE Item No. C-01-03
Turbo pumping units	1	CVSE Item No. C-01-05
Laboratory pump	2	CVSE Item No. C-01-07
CVSE monitoring unit	1	CVSE Item No. C-01-09
LHe supply Dewar's 450 l	8	CVSE Item No. C-02-01
Leak detector	1	CVSE Item No. C-03-01
Flow meter unit	1	CVSE Item No. C-03-02
High vacuum airlock	2	CVSE Item No. C-04-01

Equipment	No.	Reference
Safety unit	1	CVSE Item No. C-04-02
He I transferline	1	CVSE Item No. C-05-01
He II transferline	1	CVSE Item No. C-05-02
Filling Airlock	1	HP-2-ASED-ID-0009-.01-0A
Flushing lines	1 set	CVSE Item No. C-05-03
LHe pumping lines	1 set	CVSE Item No. C-05-04
Pirani/Penning gauge	-	-
Micrometer pressure gauge	-	-
Flexible evacuation lines	-	-
GN_2 quality 5.6	-	-
GHe quality 5.0	-	-

9.4 OPTICAL GROUND SUPPORT EQUIPMENT (OGSE)

The following OGSE will be used:

Equipment	No.	Reference
Theodolite		
Tripod for Theodolite		
Linear Measurement Device (LMD)		
Support Structure for LMD		
Angular Transfer Prism		
Alignment References		

9.5 SPECIAL EQUIPMENT

Equipment	No.	Reference
Set of Cryo CoverTest instrumentation	1	-
Cryo Cover transferline	1	-
Cryo Cover ventline	1	-
He I dewar for Cryo Cover cooling	1	-

10 CONSTRAINTS; LIMITATIONS AND RESTRICTIONS

According instrument needs tilting of cryostat around z-axis is required.

- In order to perform PACS- and SPIRE instrument tests cooler recycling (evaporator below the sorption pump) has to be performed for a period of up to 3 hours prior to a 24 - 48 hour test period. Some of these tests will be supported by tilting the cryostat around Z-axis according instrument or cryostat needs. In the instrument, the sorption cooler is horizontally mounted. The recycling has to be performed by tilting the Z-spacecraft axis in the direction, as shown in the figure below.
- PACS will be operated by tilting the cryostat around the +z-axis by -90 degrees (i.e. -y-axis pointing downwards). A short test sequence during the EQM- and PFM- tests (approximately 1 hour) will be performed with the cryostat left tilted to +20 degree, to gather correlated data referenced to the PACS ILT (Instrument Level Test) test conditions.
- SPIRE Spectrometer test to be performed for a period of 3 hours in -90 degrees round + z-axis.

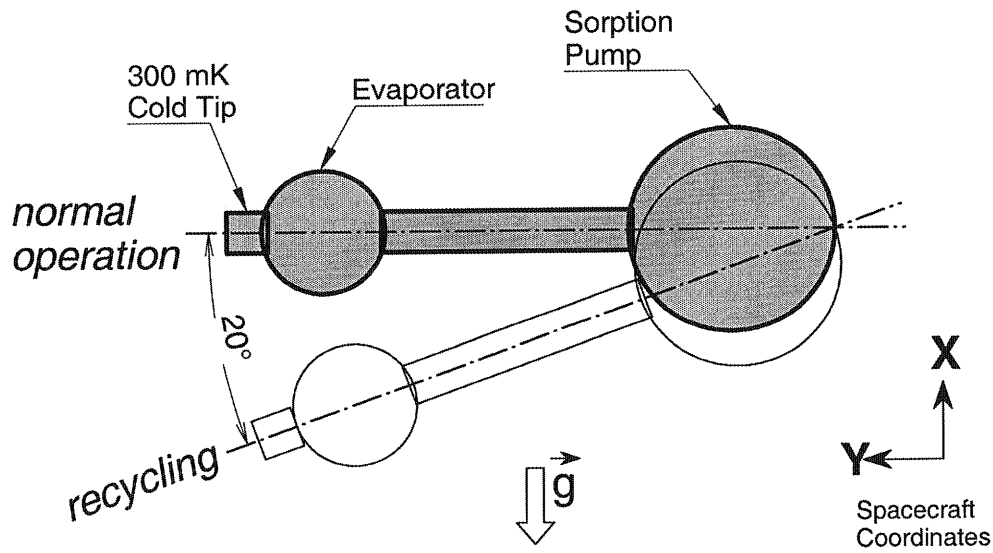


Figure 10-1: Cryostat tilting requirements for SPIRE/PACS cooler recycling

11 SHIPMENT

For more details refer also to Facility and Transportation Plan RF02

11.1 HANDLING

For handling of units and components of Herschel PLM EQM, the following points have to be respected:

- the units/components may only be touched with clean powder- and lintfree gloves
- the tables have to be clean and flat
- mounting planes have to be checked for cleanliness and damages
- before and after each plug operation, pins and sockets as well as the plugs have to be checked for cleanliness and damages
- all open plugs have to be covered with protective caps.

11.2 PACKING

For packing the original transport containers of the S/C H/W should be used as far as possible.

In other cases, it has to be assured that the components are protected against dirt, humidity, shock and vibration.

The packing has to be controlled by Quality Assurance and documented in the Log Sheet.

Clear identification and designation of the project of the container content has to be assured. Stickers like "Handle Carefully" or "Protect against Humidity", "Cleanliness sensitive – only to open in class 100" as well as indication of the external dimensions and of weight (brutto and net) have to be provided.

The original log sheets (historical record) have to be included. A copy of the log sheet remains at AIT-QA before each shipment.

11.3 STORAGE

Requirements for Storage:

- Containers must clearly indicate on 3 faces, S/C model, module, box code, or any other for identification necessary remarks.
- Storage under lock
- Storage under QA surveillance
- Items which will be stored in common storage areas have to be identified by red identification labels.

11.4 DELIVERY TO EADS ASTRIUM GMBH

Generally, all components delivered for Herschel PLM/EQM have to be routed formally through "Wareneingang" (WE) of EADS Astrium GmbH.

Here the transport papers and customs documents are controlled, provided with a WE-No. (incoming number) and stamped.

12 DETAILED ACTIVITY SHEETS

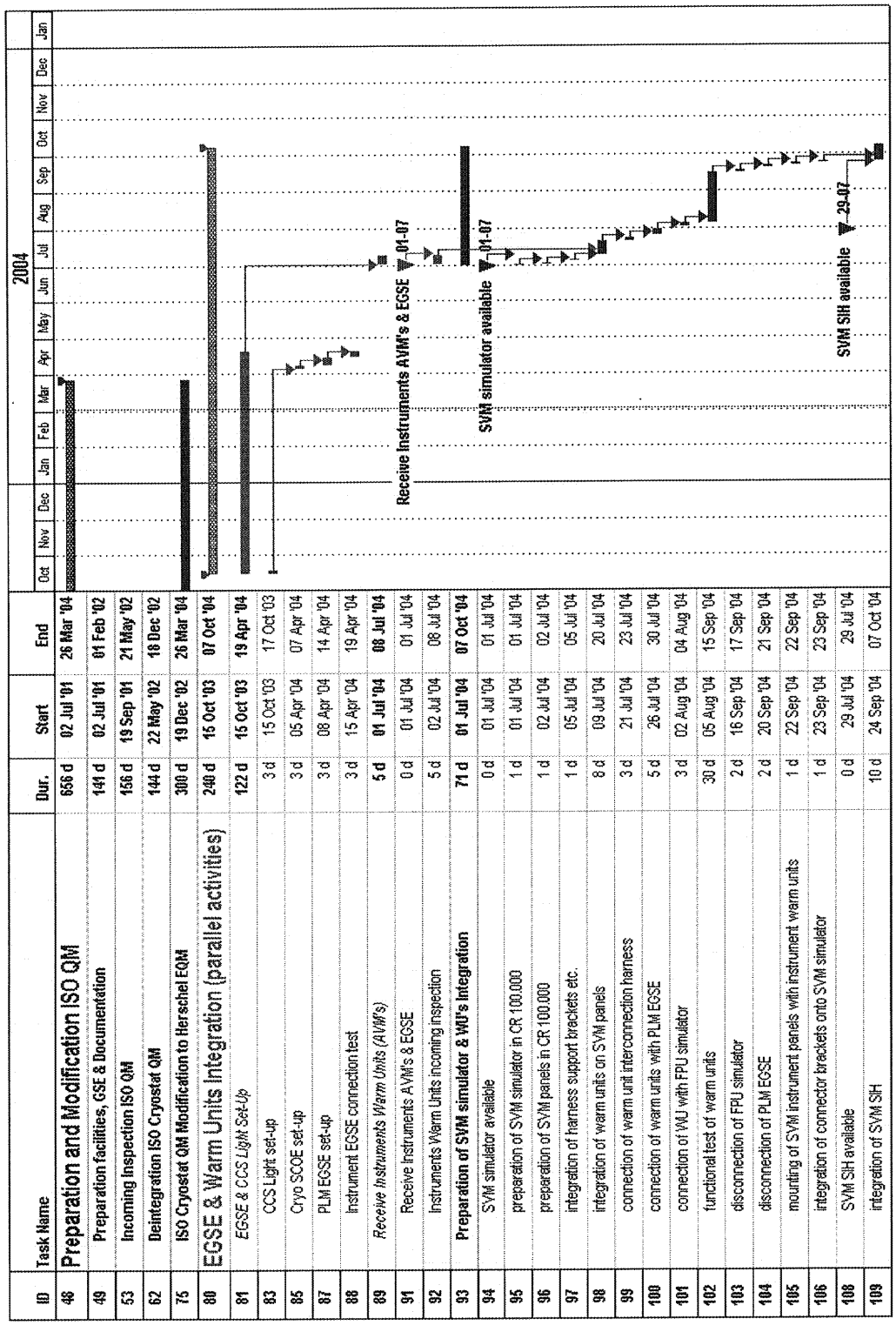
The individual activities presented in the detailed AIT flow (see chapter 12) are described in the AIT activity sheets. These sheets present the following information:

- Activity identification (ID)

  Duration (in working days) - for information only, the duration shall be taken from the schedule document
- Activity Name (accordance to AIT sequence)
- Objective
- Requirements to be verified
- Environment
- Specimen configuration (at the beginning of the task)
- Activity breakdown
- Applicable documents
- GSE required
- Facility/Instrumentation
- Personnel (AIT and QA)
- Safety precautions
- Special notes

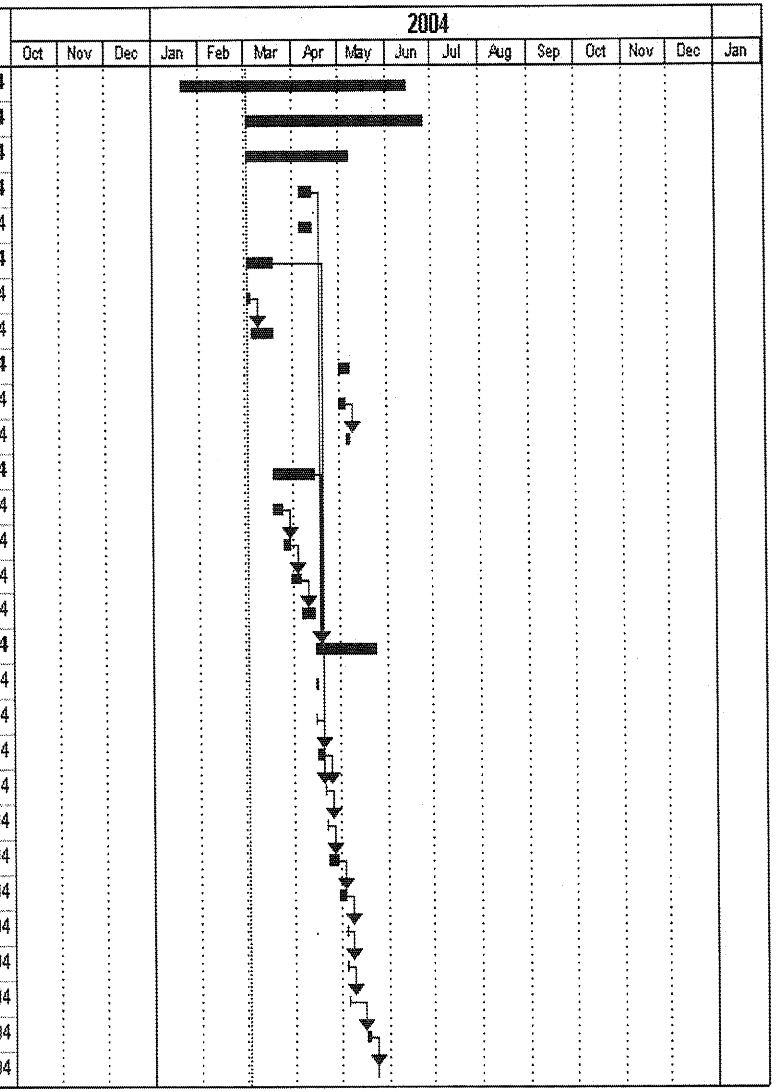
12.1 SCHEDULE (FOR INFIRMATION ONLY)

Not any change in schedule will result in a update of this AIT plan.

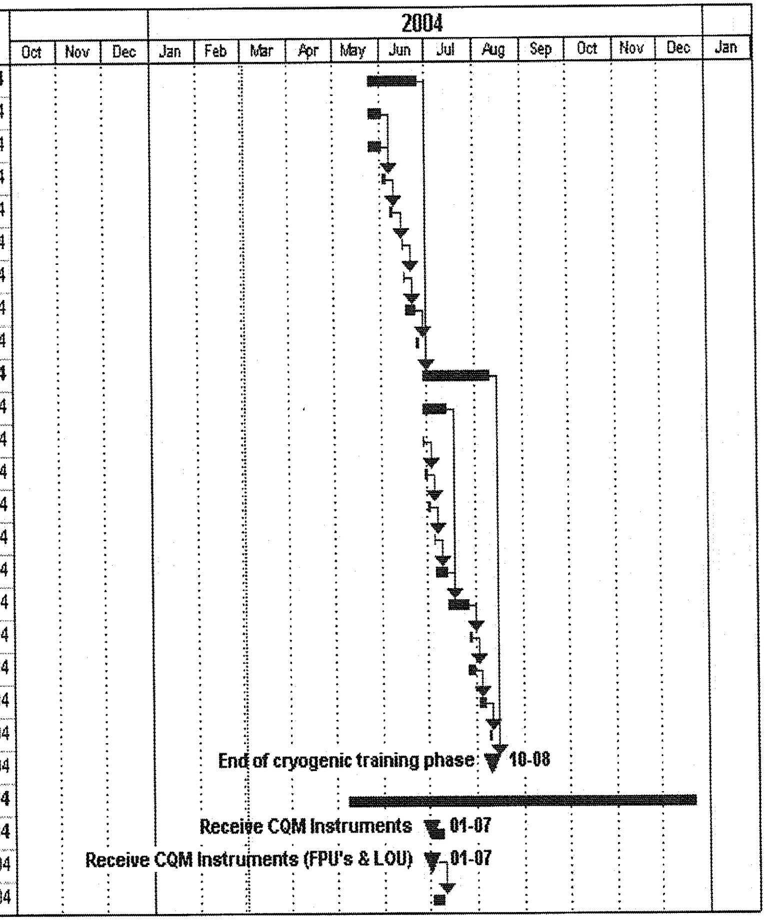


ID	Task Name	Dur.	Start	End
48	**Preparation and Modification ISO QM**	656 d	02 Jul '01	26 Mar '04
49	**Preparation facilities, GSE & Documentation**	141 d	02 Jul '01	01 Feb '02
53	**Incoming Inspection ISO QM**	156 d	19 Sep '01	21 May '02
62	**Deintegration ISO Cryostat QM**	144 d	22 May '02	18 Dec '02
75	**ISO Cryostat QM Modification to Herschel FQM**	300 d	19 Dec '02	26 Mar '04
80	**EGSE & Warm Units Integration (parallel activities)**	240 d	15 Oct '03	07 Oct '04
81	*EGSE & CCS Light Set-Up*	122 d	15 Oct '03	19 Apr '04
83	CCS Light set-up	3 d	15 Oct '03	17 Oct '03
85	Cryo SCOE set-up	3 d	05 Apr '04	07 Apr '04
87	PLM EGSE set-up	3 d	08 Apr '04	14 Apr '04
88	Instrument EGSE connection test	3 d	15 Apr '04	19 Apr '04
89	*Receive Instruments Warm Units (AVM's)*	5 d	01 Jul '04	08 Jul '04
91	Receive Instruments AVM's & EGSE	0 d	01 Jul '04	01 Jul '04
92	Instruments Warm Units incoming inspection	5 d	02 Jul '04	08 Jul '04
93	**Preparation of SVM simulator & WU's integration**	71 d	01 Jul '04	07 Oct '04
94	SVM simulator available	0 d	01 Jul '04	01 Jul '04
95	preparation of SVM simulator in CR 100.000	1 d	01 Jul '04	01 Jul '04
96	preparation of SVM panels in CR 100.000	1 d	02 Jul '04	02 Jul '04
97	integration of harness support brackets etc.	1 d	05 Jul '04	05 Jul '04
98	integration of warm units on SVM panels	8 d	09 Jul '04	20 Jul '04
99	connection of warm unit interconnection harness	3 d	21 Jul '04	23 Jul '04
100	connection of warm units with PLM EGSE	5 d	26 Jul '04	30 Jul '04
101	connection of WU with FPU simulator	3 d	02 Aug '04	04 Aug '04
102	functional test of warm units	30 d	05 Aug '04	15 Sep '04
103	disconnection of FPU simulator	2 d	16 Sep '04	17 Sep '04
104	disconnection of PLM EGSE	2 d	20 Sep '04	21 Sep '04
105	mounting of SVM instrument panels with instrument warm units	1 d	22 Sep '04	22 Sep '04
106	integration of connector brackets onto SVM simulator	1 d	23 Sep '04	23 Sep '04
108	SVM SIH available	0 d	29 Jul '04	29 Jul '04
109	integration of SVM SIH	10 d	24 Sep '04	07 Oct '04

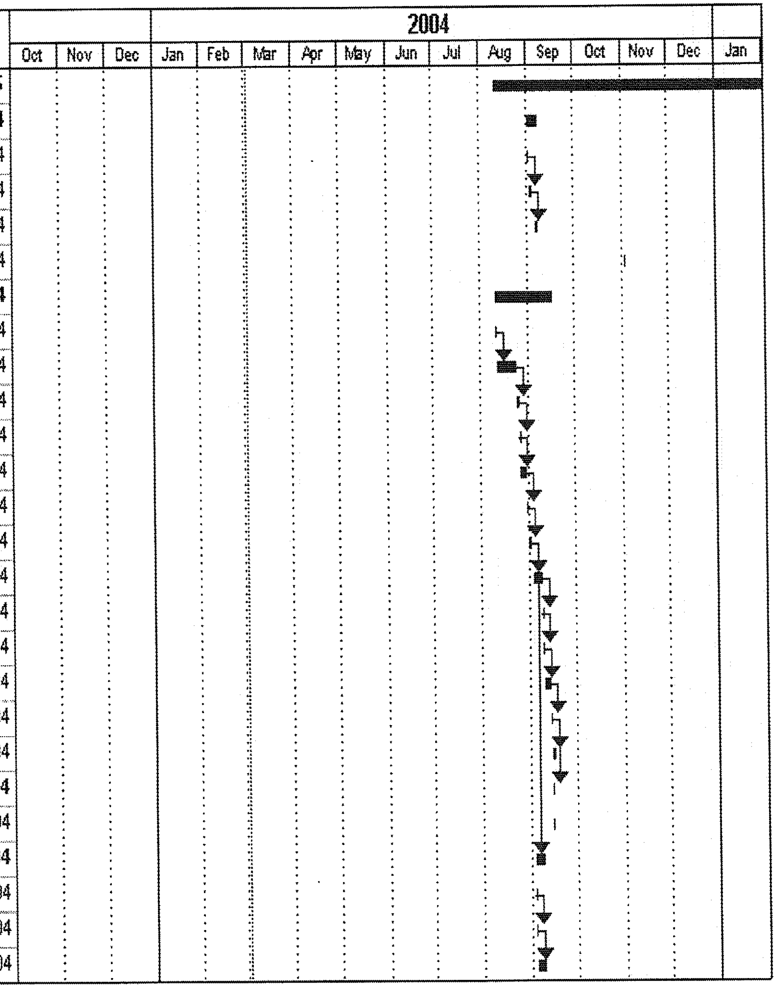
ID	Task Name	Dur.	Start	End
110	**Receive EQM Hardware - Part 1**	**98 d?**	**20 Jan '04**	**15 Jun '04**
126	**EQM Cryostat Integration in CR 100 (1)**	**77 d**	**02 Mar '04**	**25 Jun '04**
127	*Preparation & Preintegration*	**47 d**	**02 Mar '04**	**07 May '04**
128	**preparation of AXT**	**5 d**	**05 Apr '04**	**13 Apr '04**
130	preparation of AXT (sensors, harness, MLI, ...)	5 d	05 Apr '04	13 Apr '04
131	**preparation of CVV connector ring**	**13 d**	**02 Mar '04**	**18 Mar '04**
132	integration of V 512 incl. leak test	3 d	02 Mar '04	04 Mar '04
133	integration of blind connectors (instead SIH, OBA CCH) incl leaktes	10 d	05 Mar '04	18 Mar '04
134	**preparation of upper bulkhead**	**6 d**	**30 Apr '04**	**07 May '04**
135	closure of LOU windows with blind caps	3 d	30 Apr '04	04 May '04
136	integration of SV921/922	3 d	05 May '04	07 May '04
138	**Completion lower cryostat lower part**	**18 d**	**18 Mar '04**	**14 Apr '04**
139	Integration CCH I (to lower part of CVV)	5 d	18 Mar '04	24 Mar '04
140	Verification of CCH	3 d	25 Mar '04	29 Mar '04
141	integration of lower shields & instrumentation & MLI	5 d	30 Mar '04	05 Apr '04
142	integration of lower bulkhead	5 d	06 Apr '04	14 Apr '04
143	**integration of AXT/tubing/etc.**	**26 d**	**15 Apr '04**	**24 May '04**
144	mechanical integration of preintegrated AXT	2 d	15 Apr '04	16 Apr '04
145	integration of SV 723	0.5 d	15 Apr '04	15 Apr '04
146	integration of intermediate ring shields (MLI, ...)	3 d	15 Apr '04	20 Apr '04
147	integration of preintegrated CVV connector ring	1 d	20 Apr '04	21 Apr '04
148	integration of filling port on support structure	0.5 d	21 Apr '04	21 Apr '04
149	tubing adaption	5 d	22 Apr '04	28 Apr '04
150	tubing integration	3 d	29 Apr '04	03 May '04
151	integration P701	0.5 d	04 May '04	04 May '04
152	integration OBA template	0.5 d	04 May '04	04 May '04
153	tubing fixation to OBA template (incl. leak test)	1 d	05 May '04	05 May '04
154	integration of CCH batch II (to connector ring except OBA harness)	3 d	17 May '04	19 May '04
155	harness verification	1 d	24 May '04	24 May '04

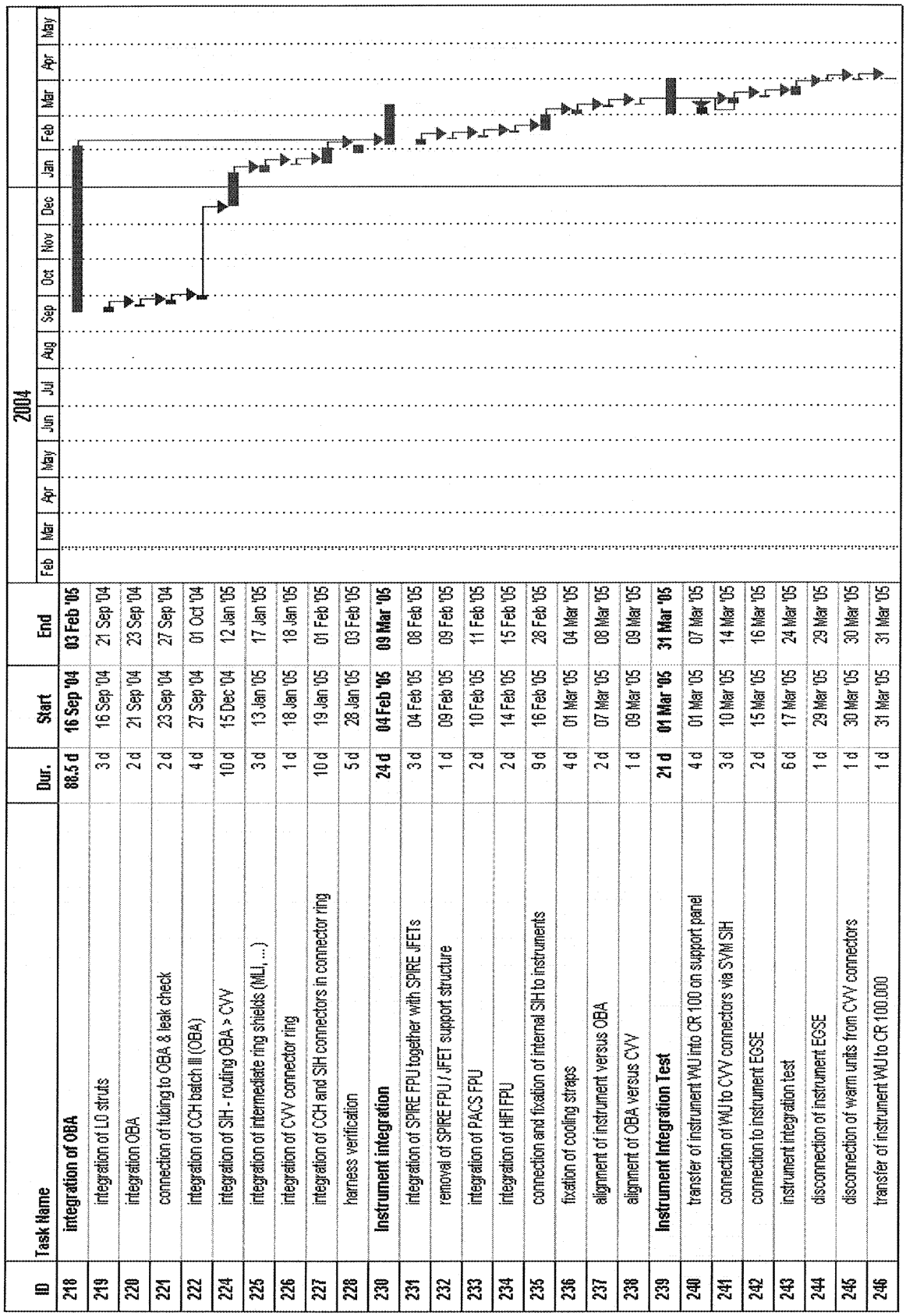


ID	Task Name	Dur.	Start	End
156	**Closure of cryostat**	**21 d**	**25 May '04**	**25 Jun '04**
157	Integration of upper shields & instrumentation & MLI	5 d	25 May '04	01 Jun '04
158	closure of shields / MLI	5 d	25 May '04	01 Jun '04
159	integration of preintegrated upper bulkhead	3 d	02 Jun '04	04 Jun '04
160	integration of filling port & leak test	2 d	07 Jun '04	08 Jun '04
162	integration of cover plate	1 d	15 Jun '04	15 Jun '04
163	installation of vacuum pumps	1 d	16 Jun '04	16 Jun '04
164	evacuation & leak test	5 d	17 Jun '04	23 Jun '04
165	transport to clean room 100.000 into test dolly	2 d	24 Jun '04	25 Jun '04
166	**Training phase**	**32 d**	**28 Jun '04**	**10 Aug '04**
167	continue evacuation	11 d	28 Jun '04	12 Jul '04
168	integration of SV121 airlock	1 d	28 Jun '04	28 Jun '04
169	connection of CVSE	2 d	29 Jun '04	30 Jun '04
170	connection of Cryo SCOE	2 d	01 Jul '04	02 Jul '04
171	Short functional test - warm	1 d	05 Jul '04	05 Jul '04
172	preparation of set-up for cooldown	5 d	06 Jul '04	12 Jul '04
173	cooldown and filling of HTT & adjustment of strap pretension	10 d	13 Jul '04	26 Jul '04
174	short functional test - cold	2 d	27 Jul '04	28 Jul '04
175	preparation of set-up for He II production	5 d	26 Jul '04	30 Jul '04
176	He II production (AXT)	5 d	02 Aug '04	06 Aug '04
177	short functional test - He II conditions	2 d	09 Aug '04	10 Aug '04
178	***End of cryogenic training phase***	0 d	10 Aug '04	10 Aug '04
179	**Receive EQM Hardware - Part 2**	**156 d**	**07 May '04**	**21 Dec '04**
187	**Receive CQM Instruments**	**5 d**	**01 Jul '04**	**08 Jul '04**
188	Receive CQM Instruments (FPU's & LOU)	0 d	01 Jul '04	01 Jul '04
189	Incoming inspection cold units	5 d	02 Jul '04	08 Jul '04



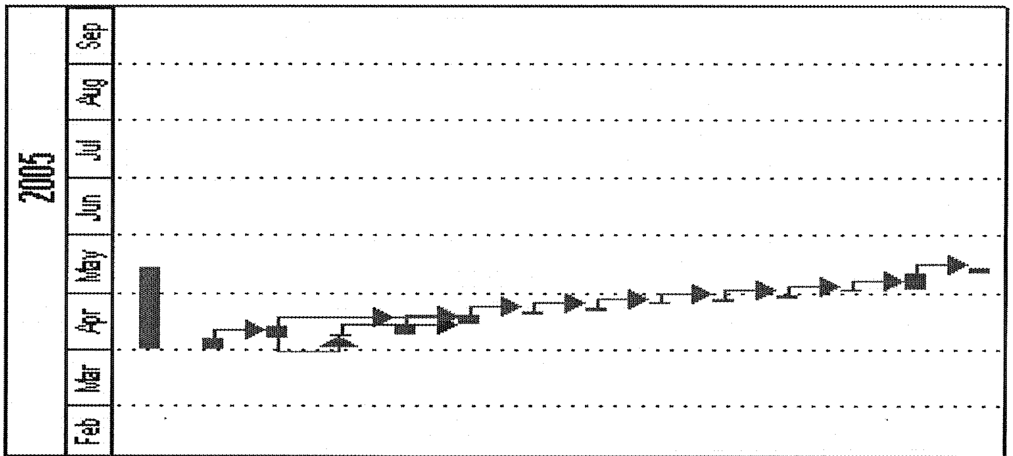
ID	Task Name	Dur.	Start	End
190	**EQM Cryostat Integration in CR 100 (2)**	**182 d?**	**11 Aug '04**	**13 May '05**
191	**preparation of OBA**	**5 d**	**01 Sep '04**	**07 Sep '04**
193	disassembly OBA shield	1 d	01 Sep '04	01 Sep '04
194	attachment of harness anchors	2 d	02 Sep '04	03 Sep '04
195	integration of sensors	2 d	06 Sep '04	07 Sep '04
196	Preparation of Cover	1 d?	02 Nov '04	02 Nov '04
197	**Opening of cryostat**	**26.5 d**	**11 Aug '04**	**16 Sep '04**
198	conversion to He I	1 d	11 Aug '04	11 Aug '04
199	Depletion and warm up & adjustment of strap pretension	8 d	12 Aug '04	23 Aug '04
200	removal of CVSE, EGSE	2 d	24 Aug '04	25 Aug '04
201	removal SV121 airlock	0.5 d	26 Aug '04	26 Aug '04
202	transfer of test dolly into CR 100	2 d	26 Aug '04	30 Aug '04
203	Pressurization of CVV to ambient	1 d	30 Aug '04	31 Aug '04
204	removal of upper bulkhead & disconnect filling port	2 d	31 Aug '04	02 Sep '04
205	removal of upper shields & MLI & shield CCH	4 d	02 Sep '04	08 Sep '04
206	disconnect tubing from OBA template	0.5 d	08 Sep '04	08 Sep '04
207	removal of OBA template	0.5 d	09 Sep '04	09 Sep '04
208	removal of CCH in connector ring	2 d	09 Sep '04	13 Sep '04
209	removal of connector ring	1 d	13 Sep '04	14 Sep '04
210	removal of intermediate ring shield & MLI	2 d	14 Sep '04	16 Sep '04
211	**preparation of CVV connector ring**	**1 d**	**14 Sep '04**	**15 Sep '04**
212	removal of blind connectors	1 d	14 Sep '04	15 Sep '04
214	**preparation of upper bulkhead**	**4 d**	**02 Sep '04**	**08 Sep '04**
215	removal of cover plate	0.5 d	02 Sep '04	02 Sep '04
216	removal of blind caps	0.5 d	03 Sep '04	03 Sep '04
217	integration of optical windows	3 d	03 Sep '04	08 Sep '04



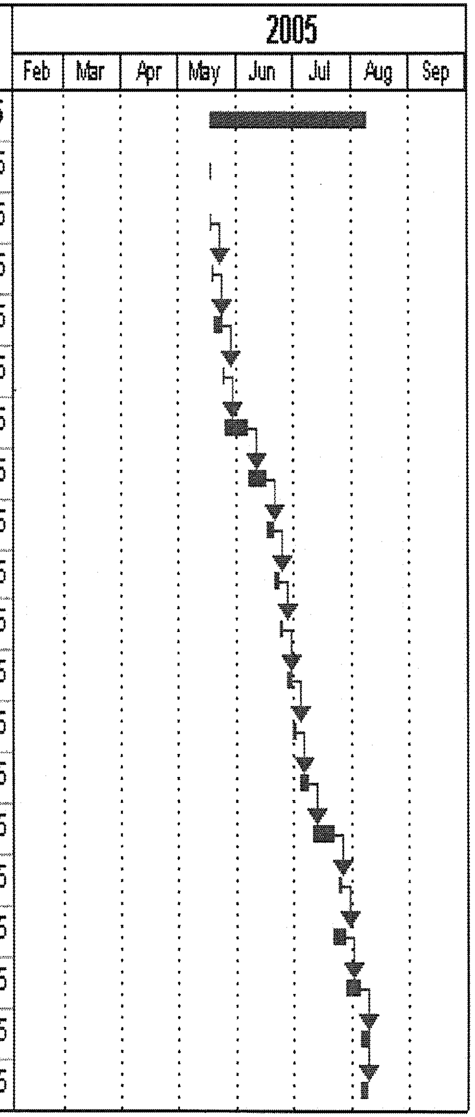


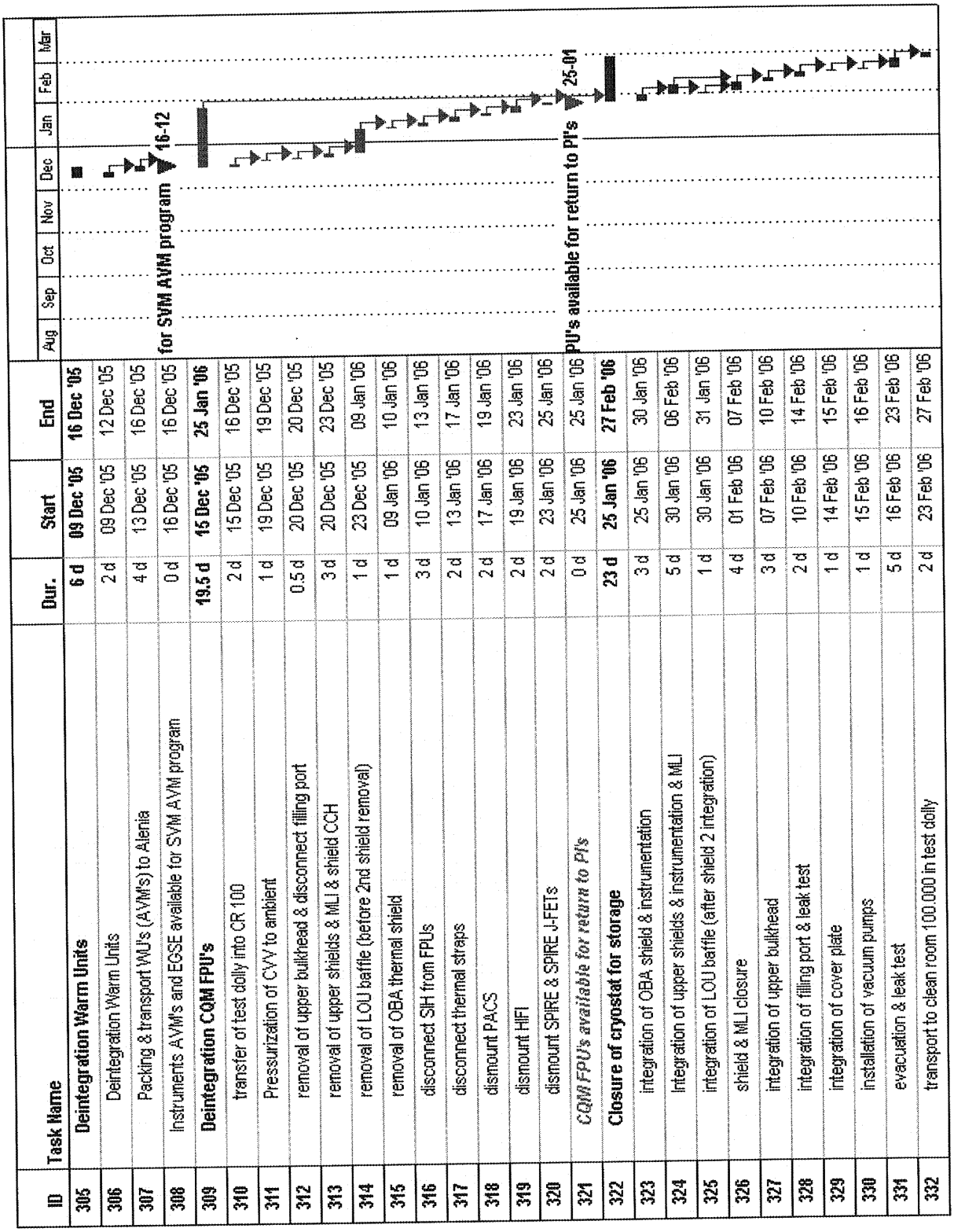
ID	Task Name	Dur.	Start	End
218	**integration of OBA**	**88.5 d**	**16 Sep '04**	**03 Feb '05**
219	integration of L0 struts	3 d	16 Sep '04	21 Sep '04
220	integration OBA	2 d	21 Sep '04	23 Sep '04
221	connection of tubing to OBA & leak check	2 d	23 Sep '04	27 Sep '04
222	integration of CCH batch III (OBA)	4 d	27 Sep '04	01 Oct '04
224	integration of SIH - routing OBA > CVV	10 d	15 Dec '04	12 Jan '05
225	integration of intermediate ring shields (MLI, ...)	3 d	13 Jan '05	17 Jan '05
226	integration of CVV connector ring	1 d	18 Jan '05	18 Jan '05
227	integration of CCH and SIH connectors in connector ring	10 d	19 Jan '05	01 Feb '05
228	harness verification	5 d	28 Jan '05	03 Feb '05
230	**Instrument integration**	**24 d**	**04 Feb '05**	**09 Mar '05**
231	integration of SPIRE FPU together with SPIRE JFETs	3 d	04 Feb '05	08 Feb '05
232	removal of SPIRE FPU / JFET support structure	1 d	09 Feb '05	09 Feb '05
233	integration of PACS FPU	2 d	10 Feb '05	11 Feb '05
234	integration of HIFI FPU	2 d	14 Feb '05	15 Feb '05
235	connection and fixation of internal SIH to instruments	9 d	16 Feb '05	28 Feb '05
236	fixation of cooling straps	4 d	01 Mar '05	04 Mar '05
237	alignment of instrument versus OBA	2 d	07 Mar '05	08 Mar '05
238	alignment of OBA versus CVV	1 d	09 Mar '05	09 Mar '05
239	**Instrument Integration Test**	**21 d**	**01 Mar '05**	**31 Mar '05**
240	transfer of instrument WU into CR 100 on support panel	4 d	01 Mar '05	07 Mar '05
241	connection of WU to CVV connectors via SVM SIH	3 d	10 Mar '05	14 Mar '05
242	connection to instrument EGSE	2 d	15 Mar '05	16 Mar '05
243	instrument integration test	6 d	17 Mar '05	24 Mar '05
244	disconnection of instrument EGSE	1 d	29 Mar '05	29 Mar '05
245	disconnection of warm units from CVV connectors	1 d	30 Mar '05	30 Mar '05
246	transfer of instrument WU to CR 100.000	1 d	31 Mar '05	31 Mar '05

ID	Task Name	Dur.	Start	End
247	**Closure of cryostat**	**29 d**	**01 Apr '05**	**13 May '05**
248	integration of OBA shield & instrumentation	3 d	01 Apr '05	05 Apr '05
249	Integration of upper shields & instrumentation & MLI	5 d	06 Apr '05	12 Apr '05
250	integration of LOU baffle (after shield 2 integration)	1 d	07 Apr '05	07 Apr '05
251	shield & MLI closure	4 d	08 Apr '05	13 Apr '05
252	integration of upper bulkhead	3 d	14 Apr '05	18 Apr '05
253	integration of filling port & leak test	2 d	19 Apr '05	20 Apr '05
254	integration of LOU support structure	2 d	21 Apr '05	22 Apr '05
255	integration of LOU	1 d	25 Apr '05	25 Apr '05
256	alignment LOU vs. OBA	2 d	26 Apr '05	27 Apr '05
257	integration of cryostat cover	2 d	28 Apr '05	29 Apr '05
258	installation of vacuum pumps	1 d	02 May '05	02 May '05
259	evacuation & leak test	5 d	03 May '05	11 May '05
260	transport to clean room 100.000 in test dolly	2 d	12 May '05	13 May '05



ID	Task Name	Dur.	Start	End
261	**EQM External Completion in CR 100.000**	**58 d?**	**17 May '05**	**08 Aug '05**
262	continue evacuation	1 d?	17 May '05	17 May '05
263	integration of SV121 airlock	1 d	17 May '05	17 May '05
264	hoisting of PLM and removal from test dolly	1 d	18 May '05	18 May '05
265	integration of PLM onto preintegrated SVM simulator	3 d	19 May '05	23 May '05
266	transfer of PLM/SVM into test dolly	1 d	24 May '05	24 May '05
268	integration of external SIH	7 d	25 May '05	06 Jun '05
269	connection to WU's (via SVM simulator)	8 d	07 Jun '05	16 Jun '05
270	integration of waveguides	2 d	17 Jun '05	20 Jun '05
271	connection of CVSE	2 d	21 Jun '05	22 Jun '05
272	connection of Cryo SCOE	2 d	23 Jun '05	24 Jun '05
273	connection of PLM EGSE to instrument warm units	3 d	27 Jun '05	29 Jun '05
274	Short functional test - warm	2 d	30 Jun '05	01 Jul '05
275	preparation of set-up for cooldown	5 d	04 Jul '05	08 Jul '05
276	cooldown and filling of HTT & adjustment of strap pretension	10 d	11 Jul '05	22 Jul '05
277	short functional test - cold	2 d	25 Jul '05	26 Jul '05
278	preparation of set-up for He II production	5 d	22 Jul '05	28 Jul '05
279	He II production and top up of HOT	5 d	29 Jul '05	04 Aug '05
280	short functional test - He II conditions	2 d	05 Aug '05	08 Aug '05
281	preparation of set-up for cover flushing	2 d	05 Aug '05	08 Aug '05





ID	Task Name	Dur.	Start	End
305	**Deintegration Warm Units**	**6 d**	**09 Dec '05**	**16 Dec '05**
306	Deintegration Warm Units	2 d	09 Dec '05	12 Dec '05
307	Packing & transport WUs (AVMs) to Alenia	4 d	13 Dec '05	16 Dec '05
308	Instruments AVM's and EGSE available for SVM AVM program	0 d	16 Dec '05	16 Dec '05
309	**Deintegration CQM FPU's**	**19.5 d**	**15 Dec '05**	**25 Jan '06**
310	transfer of test dolly into CR 100	2 d	15 Dec '05	16 Dec '05
311	Pressurization of CVV to ambient	1 d	19 Dec '05	19 Dec '05
312	removal of upper bulkhead & disconnect filling port	0.5 d	20 Dec '05	20 Dec '05
313	removal of upper shields & MLI & shield CCH	3 d	20 Dec '05	23 Dec '05
314	removal of LOU baffle (before 2nd shield removal)	1 d	23 Dec '05	09 Jan '06
315	removal of OBA thermal shield	1 d	09 Jan '06	10 Jan '06
316	disconnect SIH from FPUs	3 d	10 Jan '06	13 Jan '06
317	disconnect thermal straps	2 d	13 Jan '06	17 Jan '06
318	dismount PACS	2 d	17 Jan '06	19 Jan '06
319	dismount HIFI	2 d	19 Jan '06	23 Jan '06
320	dismount SPIRE & SPIRE J-FETs	2 d	23 Jan '06	25 Jan '06
321	*CQM FPU's available for return to PI's*	0 d	25 Jan '06	25 Jan '06
322	**Closure of cryostat for storage**	**23 d**	**25 Jan '06**	**27 Feb '06**
323	integration of OBA shield & instrumentation	3 d	25 Jan '06	30 Jan '06
324	integration of upper shields & instrumentation & MLI	5 d	30 Jan '06	06 Feb '06
325	integration of LOU baffle (after shield 2 integration)	1 d	30 Jan '06	31 Jan '06
326	shield & MLI closure	4 d	01 Feb '06	07 Feb '06
327	integration of upper bulkhead	3 d	07 Feb '06	10 Feb '06
328	integration of filling port & leak test	2 d	10 Feb '06	14 Feb '06
329	integration of cover plate	1 d	14 Feb '06	15 Feb '06
330	installation of vacuum pumps	1 d	15 Feb '06	16 Feb '06
331	evacuation & leak test	5 d	16 Feb '06	23 Feb '06
332	transport to clean room 100.000 in test dolly	2 d	23 Feb '06	27 Feb '06

LIST OF ACTIVITY SHEETS

Number	Activity/Definition	Remark
	Incoming Inspection	
E.010.010	Incoming Inspection/Status Verification	
E.010.020	Demaiting ISO SVM	
E.010.030	Installation ISO PLM in clean cabin class 100	
	Deintegration ISO cryostat QM	
E.020.010	Pressurization of PLM to ambient pressure	
E.020.020	Deintegration of CVV lower part	
E.020.030	Deintegration of CVV upper part	
E.020.040	Deintegration OSS, baffle and uxiliary tank	
E.020.050	Deintegration of ISO experiment Harness	
E.020.060	MIP 1	
	Modification ISO Cryostat QM to Herschel cryostat EQM	
E.030.010	Modification of internal He tubing	
E.030.020	Modification of internal Cryo Control Harness CCH	
E.030.030	Modification of internal MLI (HTT MLI closure)	
E.030.040	Repairs	
	EQM Cryostat Integration (1)	
E.040.010	Preparation of AXT	Offline activity
E.040.020	Preparation of CVV connector ring	Offline activity
E.040.030	Preparation of upper bulkhead	Offline activity
E.040.040	Integration of CCH I (to lower part of CVV)	
E.040.050	Integration of cryostat lower part (therm. shields and bulkhead)	
E.040.060	KIP 1	
E.040.070	Integration of AXT and leaktest	
E.040.080	Integration of CVV connector ring and intermediate thermal shields	
E.040.090	Integration of OB template	
E.040.100	Integration of CCH batch II (temporary harness upper therm. shield sensors to connector ring)	

Number	Activity/Definition	Remark
E.040.110	Integration of cryostat upper part (therm. shields and upper cone)	
E.040.120	Integration of cover closing plate	
E.040.130	PLM evacuation and leaktest	
	Training phase	
E.050.010	Move PLM in clean room class 100 000 in test dolly	
E.050.020	Short functional test (SFT) warm	
E.050.030	Cool down and filling	
E.050.040	Short functional test (SFT) cold	
E.050.050	He II production (in AXT)	
E.050.060	Short functional test - He II conditions	
E.050.070	Conversion to He I	
E.050.080	Depletion and warm up	
E.050.090	Transfer in clean room class 100	
	End of training phase	
E.060.010	Disassemble cryostat upper part	
E.060.020	Disassemble OB template	
E.060.030	Disassemble CVV connector ring	
E.060.040	Disassemble intermediate thermal shields	
	EQM Cryostat Integration (2)	
E.070.010	Preparation of OBA	Offline activity
E.070.020	Integration of OBA	
E.070.030	Integration of CCH batch III	
E.070.040	Integration of SIH (routing OBA → CVV)	
E.070.050	Preparation of connector ring and thermal shields	
E.070.060	Integration CVV connector ring and intermediate therm. shields	
E.070.070	Integration of CCH and SIH vacuum connector feedthroughs in connector ring and harness verification	
E.070.080	KIP 2	
E.070.090	Integration of instrument FPU's onto OB	

Number	Activity/Definition	Remark
E.070.100	Connection and fixation of internal SIH to instruments	
E.070.110	KIP 3	
E.070.120	Alignment of HIFI (OBA) w.r.t. CVV windows	
E.070.130	Instrument integration test	
E.070.140	Integration of OB shield and instrumentation	
E.070.150	Preparation of upper bulkhead	Offline activity
E.070.160	Integration of cryostat upper part (therm shields and upper cone)	
E.070.170	Integration of LOU and alignment of LOU vs. HIFI	
E.070.180	MIP 2	
E.070.190	Integration of cryostat cover	
E.070.200	PLM evacuation and leaktest	
E.070.210	Move PLM in clean room class 100 000 in test dolly	
	EQM External Completion in CR 100 000	
E.080.010	Integration of PLM to pre-integrated SVM simulator	
E.080.020	Integration of external SIH	
E.080.030	Integration of waveguides	
E.080.040	Connect CVSE – continue evacuation	
E.080.050	Cooldown and filling of HTT (adjustment of strap pretension)	
E.080.060	Short functional test - cold	
E.080.070	He II production (AXT)	
E.080.080	Short functional test - He II conditions	
E.080.090	Preparation of set up for cover flushing	
	EQM Test Phase	
E.090.010	Cryostat tests (CCU and instrumentation)	
E.090.020	HIFI tests	
E.090.030	PACS tests	
E.090.040	SPIRE tests	
E.090.050	PACS/SPIRE tests (parallel mode)	
E.090.060	EMC Test (RS)	

Number	Activity/Definition	Remark
E.090.070	Conversion to He 1	
E.090.080	Depletion and warm up (adjustment of strap pretension)	
	END OF EQM TESTPHASE	
E.100.010	Dismount waveguides and external SIH and LOU	
E.100.020	Demating of SVM simulator	
E.100.030	De-integration warm units	
E.100.040	Packing and transport of WU's to Alenia	
E.100.050	Move PLM into cleanroom class 100	
E.100.060	Disassemble cryostat upper part	
E.100.070	Deintegration of FPU's PACS, HIFI, SPIRE and SPIRE J-FETs	
E.100.080	Remounting of PLM for storage	
	Preparation Activities in Parallel (off line)	
E.200.010	EGSE and CCS Light Set up	
E.200.020	Integration of WU's to SVM panels	
E.200.030	Functional test of warm units	
E.200.040	Complete SVM simulator pre-integration	

Activity Number:	E.010.010	**Duration:**	5 days
Activity Name:	Activity Name: Incoming Inspection/Status Verification	**Model:**	EQM

Objective: Incoming inspection after transport and verification of actual status of the PLM He subsystem

Requirements to be verified:

n. a.

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:

- ISO PLM/QM mounted in transport container. X-axis horizontal
- PLM cover not mounted (cover evacuation plate mounted)
- Outer MLI not mounted

Activity Breakdown:

- Perform cleaning of transport container after transport.
- Move container in airlock of clean room cl. 100 000.
- Opening of transport container
- Incoming inspection
- Cleanliness inspection/cleaning of PLM
- Installation of PLM in test dolly
- Perform ISO PLM/QM Inspection and Status Verification

Applicable Documents:

- Test dolly handling manual
- Lifting device handling manual
- ISO PLM/QM Inspection and Status Verification before Deintegration Procedure

GSE required:

- Transport Container
- PLM Test dolly
- PLM Hoisting device

Facility instrumentation:

- Astrium OTN building 5.0; clean room class 100 00
- Facility crane, standard hoisting slings
- Cleaning equipment

Personnel:

- Crane operator
- AIT engineer
- AIT technician
- QA

Safety Precautions:

- Standard safety precautions for crane operations are applicable.

Special Notes:

n. a

Activity Number:	E.010.020	**Duration:**	4 days
Activity Name:	Demating ISO SVM	**Model:**	EQM

Objective: Dismounting of PLM H/W not needed for Herschel EQM

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:
- ISO PLM/QM mounted in test dolly

Activity Breakdown:

- Prepare support stand for ISO SVM
- Connect hoisting device to ISO PLM
- Dismount ISO PLM from test dolly
- Move ISO PLM upon SVM support stand and couple SVM with support stand
- Dismount SVM from PLM
- Remount PLM in test dolly
- Dismount star tracker housing
- Dismount PLM external cryo. harness
- Check/Adjust strap pretension to nom. Value of approx. 5 KN

Applicable Documents:
- Test dolly handling manual
- Lifting device handling manual
- ISO PLM/QM Inspection and status verification before deintegration HP-2-ASED-PR-0005

GSE required:
- Adequate PLM SVM support stand
- PLM Test dolly
- PLM Hoisting device
- 16 Strap pretension measurement devices

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Facility crane, standard hoisting slings
- Cleaning equipment

Personnel:
- Crane operator
- AIT engineer
- AIT technician
- QA

Safety Precautions:

- Standard safety precautions for crane operations are applicable.

Special Notes:
n. a

Activity Number: E.010.030 **Duration:** 2 days

Activity Name: Installation ISO PLM in clean cabin class 100 **Model:** EQM

Objective: Provision of ISO PLM in clean cabin cl. 100 mounted in integration dolly

Requirements to be verified:

n. a.

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000/100

Configuration:

- Integration dolly finally placed in clean cabin cl. 100
- PLM partly dismounted, mounted in test dolly, placed in clean room cl.100 000 in front of clean cabin cl. 100

Activity Breakdown:

- Perform cleaning of PLM. According cl. 100 requirements
- Perform cleaning of PLM hoisting device. According cl. 100 requirements
- Install hoisting device to PLM.
- Disconnect PLM from test dolly
- Move PLM in clean cabin cl. 100 and install PLM in integration dolly. PLM Z-axis adapted to integration dolly

Applicable Documents:

- Test dolly handling manual
- Integration dolly handling manual
- Lifting device handling manual
- ISO PLM deintegration procedure

GSE required:

- PLM Test dolly
- PLM Integration dolly
- PLM Hoisting device

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Facility crane, standard hoisting slings
- Cleaning equipment

Personnel:

- Crane operator
- AIT engineer
- AIT technician
- QA

Safety Precautions:

- Standard safety precautions for crane operations are applicable.

Special Notes:

n. a.

Activity Number: E.020.010 **Duration:** 1 day

Activity Name: Pressurization of PLM to ambient pressure **Model:** EQM

Objective: To obtain ambient pressure inside PLM

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- PLM mounted in integration dolly
- CVV under vacuum

Activity Breakdown:

- Install ISO vacuum lock (SV 922) to PLM upper cone
- Install pressurization equipment
- Pressurize PLM with GN2 to approx. 1bar
- Remove cover evacuation plate

Applicable Documents:
- ISO PLM deintegration procedure

GSE required:
- GN2 pressurization equipment
- ISO vacuum lock (SV 922)

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Facility crane, standard hoisting slings
- Cleaning equipment

Personnel:
- AIT engineer
- AIT technician
- QA representative

Safety Precautions:

- Standard safety precautions for crane operations are applicable.

Special Notes:

n. a.

Activity Number: E.020.020 **Duration:** 5 days

Activity Name: Deintegration of CVV lower part **Model:** EQM

Objective: Dismounting of CVV lower part

Requirements to be verified:

n. a.

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- ISO PLM mounted in integration dolly
- Cover evacuation plate dismounted

Activity Breakdown:

- Tilt PLM with integration dolly. PLM –X-axis top
- Install lower bulkhead lifting device
- Dismount lower bulkhead
- Dismounting of, one after another, lower conical shield 1, 2, and 3

  - disconnect electrical connectors in between shield 1, 2 and 3

  - MLI dismounting/opening (shield to shield)
- Storage of lower bulkhead and lower shields

Applicable Documents:

- ISO PLM Deintegration procedure

GSE required:

- Lower bulkhead lifting device

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Facility crane, standard hoisting slings

Personnel:

- AIT engineer
- AIT technician
- Electrical technician
- MLI technician
- QA

Safety Precautions:

- Standard safety precautions for crane operations are applicable.

Special Notes:

n. a.

Activity Number:	E.020.030	**Duration:**	5 days
Activity Name:	Deintegration of CVV upper part	**Model:**	EQM

Objective: Dismounting of CVV upper part

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- ISO PLM mounted in integration dolly
- CVV lower part dismounted

Activity Breakdown:
- Tilt PLM with integration dolly +X-axis top
- Install upper cone lifting device
- Dismount upper cone
  - Dismount He filling tube from upper cone
- Dismounting of, one after another, upper conical shield 1, 2, and 3
  - disconnect electrical connectors in between shield 1, 2, and 3
  - MLI dismounting/opening (shield to shield)
- Storage of upper and upper shields

Applicable Documents:
- ISO PLM Deintegration procedure

GSE required:
- Upper cone lifting device

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Facility crane, standard hoisting slings
- Cleaning equipment

Personnel:
- Crane operator
- AIT engineer
- AIT technician
- electrical technician
- MLI specialist
- QA

Safety Precautions:
- Standard safety precautions for crane operations are applicable.

Special Notes:
n. a.

Activity Number:	E.020.040	**Duration:**	10 days
Activity Name:	Dismounting of OSS, Baffle and Auxiliary tank	**Model:**	EQM

Objective: Deintegration of ISO H/W not needed for Herschel EQM

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- ISO PLM mounted in integration dolly; X-axis vertical, +X-axis top
- CVV lower part dismounted
- CVV upper part dismounted

Activity Breakdown:
- Dismounting of ISO aux. Tank
  - disconnect aux. tank tubing
  - electrical disconnection of aux. tank instrumentation
  - dismount aux. Tank
  - storage of aux. tank
- Dismounting of ISO OSS
  - dismount OSS shield
  - electrical disconnection of OSS instrumentation
  - disconnect OSS tubing
  - disconnect cooling straps
  - Tilt PLM with integration dolly –X-axis top
  - dismount OSS
  - storage of OSS
- Dismounting of ISO baffle
  - Tilt PLM with integration dolly +X-axis top

Activity Breakdown (cont'd):
  - dismount baffle MLI
  - disconnect baffle instrumentation
  - disconnect baffle tubing
  - dismount baffle
  - storage of baffle

Applicable Documents:
- ISO PLM Deintegration procedure

GSE required:
- OSS lifting device
- Baffle lifting device

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Facility crane, standard hoisting slings
- Cleaning equipment

Personnel:
- Crane operator
- AIT engineer
- AIT technician
- Electrical technician
- MLI technician
- QA representative

Safety Precautions:

- Standard safety precautions for crane operations are applicable.

Special Notes:
n. a.

Activity Number: E.020.050 **Duration:** 8 days

Activity Name: Dismounting of ISO experiment harness **Model:** EQM

Objective: Deintegration of ISO H/W not needed for Herschel EQM

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- ISO PLM in integration dolly
  - Baffle dismounted
  - OSS dismounted
  - aux. tank dismounted

Activity Breakdown:
- disconnect ISO experiment harness from lower spatial framework I/F
- dismount ISO experiment Harness

Applicable Documents:
- ISO PLM Deintegration procedure

GSE required:
-

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100

Personnel:
- AIT engineer
- Harness technician
- QA

Safety Precautions:
- Standard safety precautions are applicable

Special Notes:
n. a.

Activity Number:	E.020.060	**Duration:**	1 day
Activity Name:	MIP 1	**Model:**	EQM

Objective: Review of H/W status and corresponding documentation

Applicable Documents:

- Herschel PLM EQM documentation

Requirements to be verified:

n. a.

GSE required:

-

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Facility instrumentation:

- Astrium OTN premises

Configuration:

- PLM mounted in integration dolly

Personnel:

- AIT engineer
- PLM S/S representative
- Customer representatives
- PA

Activity Breakdown:

- Review of documentation:
  - CIDL/ CSL
  - As-built documentation status
  - NCR-status
  - Procedures and logsheet status
  - Open works
- Cleanliness status
- Hardware inspection
- Conclusion

Safety Precautions:

n.a.

Special Notes:

n. a.

Activity Number:	E.030.010	**Duration:**	30 days
Activity Name:	Modification of internal He tubing	**Model:**	EQM

Objective: Adaptation of internal He tubing according Herschel PLM/EQM needs

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- PLM mounted in integration dolly

Activity Breakdown:
- Arrange PLM position with integration dolly for optimal access
- Perform adaptation of internal He tubing wrt. to the following I/F's
  - baffle
  - OSS
  - aux. tank
  - aux. tank ventline
  - filling port
- For welded I/F adaptations install adequate protections
- Perform X-ray analysis of welded tubing I/F's
- perform leak check of internal He tubing adaptations
- Perform cleanliness verification of internal He tubing

Applicable Documents:
- ISO PLM Deintegration procedure
- Internal He tubing modification procedure

GSE required:
- Integration dolly
- Working platform
- Leaktest equipment
- Tube welding machine
- X-ray analysis equipment
- Standard cleaning equipment

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100

Personnel:
- AIT engineer
- AIT technician
- Welding expert
- X-ray analysis personal
- QA

Safety Precautions:
- Standard safety precautions are applicable
- X-ray analysis safety precautions
- Welding safety precautions

Special Notes:
n. a.

Activity Number: E.030.020 **Duration:** 20 days

Activity Name: Modification of internal Cryo Control Harness CCH **Model:** EQM

Objective: Adaptation of internal CCH according Herschel PLM/EQM needs

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly
- Pre-assembled and released CCH adaptations available

Activity Breakdown:

- Adaptation of existing CCH
- Preparation of CCH fixation areas
- Integration of modified CCH
- Electrical test of modified CCH

Applicable Documents:

- ISO PLM Deintegration procedure
- CCH interconnection diagramm

GSE required:
-

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100

Personnel:
- Harness technicians
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number: E.030.030 **Duration:** 20 days

Activity Name: Modification of internal MLI **Model:** EQM

Objective: Closure of HTT inner wall with MLI

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly

Activity Breakdown:

Perform integration of additional internal HTT MLI:

- Gluing of MLI stand offs to HTT inner wall according templates
- Final inspection of additional HTT MLI
- Installation of additional HTT MLI
- Check grounding

Applicable Documents:

- ISO PLM Deintegration procedure
- Additional HTT MLI assembly drawing

GSE required:
-

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100

Personnel:

- MLI specialists
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:
n. a.

Activity Number: E.030.040
Activity Name: Repairs of PLM H/W
Duration: 5 days
Model: EQM

Objective: Exchange of leaky strap tensioning device

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly

Activity Breakdown:

- Perform repair of strap tensioning device:
  - Dismounting of strap pretension measurement device
  - Deintegration of strap tensioning device
  - Integration of spare strap tensioning device
  - Perform leak check of exchanged strap tensioning device
  - Reinstallation of strap pretension measurement device

Applicable Documents:

- ISO PLM Deintegration procedure

GSE required:

- Leaktest equipment
- Special evacuation cup
- Strap pretension measurement device

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100

Personnel:
- AIT engineer
- AIT technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a

Activity Number: E.040.010 **Duration:** 5 days

Activity Name: Preparation of AXT **Model:** EQM

Objective: Preparation of AXT for integration

Requirements to be verified:

- electrical continuity of AXT-sensors and cabling
- MLI grounding

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- AXT placed on table
- AXT finally cleaned and released for integration

Activity Breakdown:

Preparation of AXT for integration

- Final inspection of AXT
- Integration of AXT CFRP support blades
- Integration of AXT sensors and Cabling
- Mech. check: dimensions, screw torque, screw locking etc.
- Installation of AXT MLI
- Perform electrical check of AXT instrumentation and harness
- Check of MLI grounding

Applicable Documents:

- Herschel PLM/EQM Integration procedure
- AXT assembly drawing

GSE required:

- Standard hoisting slings
- Working table

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:

- Crane operator
- AIT technician
- MLI specialist
- Harness technician
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.040.020	**Duration:**	13 days
Activity Name:	Preparation of CVV connector ring	**Model:**	EQM

Objective: Preparation of CVV connector ring for integration

Requirements to be verified:

- Leakrate of vacuum feedthroug connector blind plugs and V512 I/F's to CVV $\leq 1x10^{-8}$ mbarls^{-1}

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- Connector ring placed on adequate support
- Connector ring finally cleaned and released for integration

Activity Breakdown:

Preparation of connector ring for integration

- Final inspection of connector ring, V512 and vacuum feedthrough connector blind plugs
- Installation of vacuum feedthrough connector blind plugs
- Leaktest of vacuum feedthrough connector blind plugs
- Integration of V512
- Leaktest of V512

Applicable Documents:

- Herschel PLM/EQM Integration procedure

GSE required:

- standard hoisting slings
- Leak test equipment
- Feed through connector evacuation cup

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:

- 1 crane operator
- 2 AIT technician (vacuum serviceable)
- 1 QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.040.030	**Duration:**	6 days
Activity Name:	Preparation of upper bulkhead	**Model:**	EQM

Objective: Preparation of upper bulkhead for integration

Requirements to be verified:

- Leakrate of LOU window blind caps and SV921/922 I/F's to CVV $\leq 1x10^{-8}$ mbarls^{-1}

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- Upper bulkhead placed on adequate support
- Upper bulkhead finally cleaned and released for integration

Activity Breakdown:

Preparation of upper bulkhead for integration

- Final inspection of upper bulkhead and LOU window blind caps
- Installation of LOU window blind caps
- Leaktest of LOU window blind caps
- Final inspection of SV921/922
- Integration of SV921/922
- Leaktest of SV921/922 I/F to CVV
- Mount CVV upper bulkhead plate (I/F to cryo cover)

Applicable Documents:

- Herschel PLM/EQM Integration procedure
- Upper bulkhead assembly drawing

GSE required:

- standard hoisting slings
- Leak test equipment
- LOU window Special evacuation cup

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:

- Crane operator
- AIT technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number: E.040.040 **Duration:** 8 days

Activity Name: Installation of internal CCH I **Model:** EQM

Objective: Installation, routing and verification of PLM internal CCH I (lower part of CVV)

Requirements to be verified:

- Leakrate of vacuum feedthroug connector I/F's to CVV $\leq 1x10^{-8}$ mbarls^{-1}
- Circuit continuity of harness

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly + X-axis top

Activity Breakdown:

- Preparation of harness fixation areas
- Final inspection of internal CCH I
- Integration of CCH I
- Perform leaktest of installed vacuum connector feedthroughs
- Perform interconnections internal CCHI
- Electrical check out of CCH I

Applicable Documents:

- CCH I integration and verification procedure
- CCH I routing drawing

GSE required:

- PLM integration dolly
- Electrical check out equipment (IDAS)
- Leak test equipment
- Feed through connector evacuation cup

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Cleaning-/Cleanliness inspection equipment

Personnel:

- AIT technician (vacuum serviceable)
- Harness technicians
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.040.050	**Duration:**	10 days
Activity Name:	Integration of cryostat lower part (therm. shields and lower bulkhead)	**Model:**	EQM

Objective: Integration of lower thermal shields and lower bulkhead

Requirements to be verified:

- Circuit continuity of instrumentation cabling

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly -X-axis top
- Lower shields preintegrated with, MLI and instrumentation (lower thermal shields and lower bulkhead already mounted and used for ISO EQM program)

Activity Breakdown:

- Final inspection of PLM lower part
- Final cleaning and final inspection of lower shield 1, 2, 3 and lower bulkhead
- Successive mechanical installation of lower shield 1, 2, 3
  - Successive interconnection of shield instrumentation cabling from lower shield 1, 2 and 3 to cyl. shield 1, 2, and 3
  - Perform electrical check of shield instrumentation after each connection
  - Successive MLI closure (lower shield to cyl. shield)
- Integration of lower bulkhead
- Mech. check: dimensions, screw torque, screw locking etc.

Applicable Documents:

- Herschel EQM PLM Integration procedure
- Assembly drawing PLM lower part

GSE required:

- PLM integration dolly
- Standard hoisting slings
- Circuit continuity measurement equipment

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:

- Crane operator
- AIT technicians (vacuum serviceable)
- Electrical technician
- MLI specialists
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:

n. a.

Activity Number: E.040.060 **Duration:** 1 day
Activity Name: KIP 1 **Model:** EQM

Objective: Review of EQM H/W status and corresponding documentation

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- PLM mounted in integration dolly

Activity Breakdown:
- Review of documentation:
  - CIDL/ CSL
  - As-built documentation status
  - NCR-status
  - Procedures and logsheet status
  - Open works
- Cleanliness status
- Hardware inspection
- Conclusion

Applicable Documents:
- Herschel EQM PLM documentation

GSE required:
n.a.

Facility instrumentation:
- Astrium OTN premises

Personnel:
- AIT engineer
- PLM S/S representative
- 1 PA

Safety Precautions:
n.a.

Special Notes:
n. a.

Activity Number: E.040.070 **Duration:** 2 days

Activity Name: Integration of AXT and leaktest **Model:** EQM

Objective: Integration of preintegrated AXT into PLM

Requirements to be verified:

- Leakrate of AXT tubing I/F's ≤ $1x10^{-8}$ $mbarls^{-1}$

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly + X-axis top
- AXT preintegrated and released for integration

Activity Breakdown:

- Final cleaning and final inspection of AXT and associated mounting H/W
- Integration of AXT into PLM
- Mech. check: dimensions, screw torque, screw locking etc.
- connect AXT tubing
- Perform leak check of AXT tubing I/F
- Complete routing of AXT instrumentation harness
- Electrical check of AXT instrumentation and harness
- Complete/Closure of AXT MLI

Applicable Documents:

- Herschel PLM/EQM Integration procedure

GSE required:

- standard hoisting slings
- PLM integration dolly
- Working platform
- Leak test equipment

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin
- class 100
- Facility crane

Personnel:

- 1 crane operator
- 2 AIT technician (vacuum serviceable)
- 1 harness technician
- 1 QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.040.080	**Duration:**	4 days
Activity Name:	Integration of CVV connector ring and intermediate therm. shields	**Model:**	EQM

Objective: Mechanical integration of intermediate thermal shields and CVV connector ring

Requirements to be verified:

- Leakrate of V512 I/F to OB outlet tube $\leq 1x10^{-8}$ mbarls^{-1}

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly + X-axis top
- CVV connector ring preintegrated with blind connectors and V512
- Intermediate thermal shields preintegrated with MLI

Activity Breakdown:

- Final inspection of intermediate thermal shields
- Preinstall OB outlet tube
- Successive mechanical installation of intermediate thermal shield 1, 2, 3
  - Successive MLI Integration/Closure from intermediate shield 1, 2 and 3 to cyl. shield 1, 2, and 3
- Final inspection of CVV connector ring
- Integration of CVV connector ring
  - Connect V512 with OB outlet tube
  - Leaktest of I/F V512 to OB outlet tube
- Mech. check: dimensions, screw torque, screw locking etc.

Applicable Documents:

- PLM/EQM integration procedure

GSE required:

- PLM integration dolly
- Standard hoisting slings
- Working platform
- Leak test equipment

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:

- Crane operator
- AIT technicians (vacuum serviceable)
- MLI specialists
- 1QA

- **Safety Precautions:**

Standard safety precautions for crane operations are applicable

Special Notes:

n. a.

Activity Number:	E.040.090	**Duration:**	1,5 days
Activity Name:	Integration of OB template	**Model:**	EQM

Objective: Mechanical integration of optical bench template

Requirements to be verified:

- Leakrate of OB template connection tube I/F's $\leq 1x10^{-8}$ mbarls^{-1}

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly+ X-axis top
- Optical bench fixation brackets preintegrated to OB template lower side. Connection tube not mounted to OB template. All H/W released for integration

Activity Breakdown:

- Final inspection of OB template
- Mechanical installation of OB template to PLM upper spatial framework
- Mech. check: dimensions, screw torque, screw locking etc.
- install OB template connection tube
- Perform leak check of OB template connection tube I/F's

Applicable Documents:

- PLM/EQM integration procedure
- OBA template assembly drawing

GSE required:

- PLM integration dolly
- Standard hoisting slings
- Leaktest equipment

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:

- Crane operator
- AIT technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:

n. a.

Activity Number: E.040.100 **Duration:** 4 days

Activity Name: Integration of CCH batch II **Model:** EQM

Objective: Installation, routing and verification of PLM internal CCH II (upper part of CVV)

Requirements to be verified:

- Leakrate of vacuum feedthroug connector I/F's to CVV $\leq 1x10^{-8}$ mbarls^{-1}
- Circuit continuity of harness

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly -X-axis top

Activity Breakdown:

- Preparation of harness fixation areas
- Final inspection of internal CCH batch II
- Integration/Routing of CCH batch II
- Perform leaktest of installed vacuum connector feedthroughs of CCH batch II
- Perform interconnections internal CCH batch II
- Electrical check out of CCH batch II

Applicable Documents:

- CCH batch II integration and verification procedure
- CCH batch II routing drawing

GSE required:

- PLM integration dolly
- Electrical check out equipment (IDAS)
- Leak test equipment
- Feed through connector evacuation cup

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Cleaning-/Cleanliness inspection equipment

Personnel:

- AIT technician (vacuum serviceable)
- Harness technicians
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.040.110	**Duration:**	13 days
Activity Name:	Integration of Cryostat upper part (thermal shields and upper cone)	**Model:**	EQM

Objective: Integration of upper conical shield and upper bulkhead

Requirements to be verified:

- Leakrate of fill/vent tube I/F to upper cone $\leq 1x10^{-8}$ mbarls^{-1}

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly -X-axis top
- CVV upper bulkhead plate (I/F to cry. cover) pre-integrated to upper bulkhead

Activity Breakdown:

- Inspection PLM upper part
- Final cleaning and final inspection of upper therm. shields and upper bulkhead
- Successive interconnection of upper shield 1, 2, 3 inclusive cover- and LOU baffle
  - Successive interconnection of shield instrumentation cabling from upper shield 1, 2 and 3 to cyl. Shield 1, 2, and 3
  - Perform electrical check of shield instrumentation after each plug connection
  - Successive MLI closure (upper therm. shields to cyl. therm shields)
- Integration of upper cone and connection of fill vent tube

Activity breakdown (cont'd)

- Perform leak check of fill/vent tube I/F to upper cone
- Mech. Check dimensions screw torque, screw locking etc.

Applicable Documents:

- PLM/EQM integration procedure
- Assembly drawing PLM upper part

GSE required:

- PLM integration dolly
- Standard hoisting slings
- Leaktest equipment
- Circuit continuity measurement equipment

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:

- Crane operator
- AIT technician vacuum serviceable)
- electrical technician
- MLI specialist
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:

n. a.

Activity Number:	E.040.120	**Duration:**	1 day
Activity Name:	Integration of cover closing plate	**Model:**	EQM

Objective: Integration of cover closing plate to upper cone I/F

Requirements to be verified:

n.a.

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly+ X-axis top
- CVV upper bulkhead plate preinstalled to upper cone

Activity Breakdown:

- Final inspection of cover closing plate and CVV I/F
- Mechanical installation of cover closing plate
- Mech. check: dimensions, screw torque, screw locking etc.

Applicable Documents:

- PLM/EQM integration procedure
- CVV/cover closing plate assembly drawing

GSE required:

- PLM integration dolly
- standard hoisting slings

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Facility crane
- Standard cleaning equipment

Personnel:

- Crane operator
- AIT technician
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:

n. a.

Activity Number:	E.040.130	**Duration:**	6 days
Activity Name:	PLM evacuation and leak test	**Model:**	EQM

Objective: Evacuation of PLM and verification of CVV- and internal He subsystem leak tightness

Requirements to be verified:

- local leakrates $\leq 1x10^{-8}$ mbarls^{-1}
- global leakrate $< 10x10^{-6}$ mbarls^{-1}

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly
- CVV closed

Activity Breakdown:

- Integration of SV121 airlock
- Integration of CVV evacuation port
- Connect evacuation equipment to evacuation port (leaktester connected parallel behind turbo pump)
- Leak check of evacuation line
- Evacuate PLM vacuum vessel (controlled evacuation, to avoid MLI damage)
- Perform integral leak check of He-subsystem against inner vessel. Documentation of result
- Perform local leak check of CVV O-ring seals:
  - lower bulkhead
  - upper cone I/F's
  - connector ring
  - cover closing plate I/F to CVV

  against ambient

Activity Breakdown: (cont'd)

- Perform local leak check of filling port I/F to upper cone
- Perform local leak check of upper cone safety valve I/F's to upper cone

Perform local leak check of V 512 I/F to upper cone

Applicable Documents:

- PLM/EQM integration procedure
- CVSE installation drawing

GSE required:

- PLM integration dolly
- Leaktest equipment
- PLM evacuation lines
- PLM evacuation equipment (Turbo pump and High vacuum pumping unit)

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Standard cleaning equipment

Personnel:

- Crane operator
- AIT/CVSE technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:

n. a.

Activity Number:	E.050.010	**Duration:**	2 days
Activity Name:	Move PLM in clean room class 100 000 in test dolly	**Model:**	EQM

Objective: Dismounting of PLM from Integration dolly, movement in clean room class 100 000 and reinstallation in test dolly

Applicable Documents:
- PLM/EQM integration procedure
- PLM hoisting equipment handling manual
- PLM Test dolly handling manual

Requirements to be verified:
n.a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

GSE required:
- PLM integration dolly
- PLM hoisting equipment
- PLM test dolly (SN03, expanded in width)
- Working Platform

Configuration:
- PLM mounted in integration dolly.
- PLM under vacuum and successfully leak tested
- Test dolly prepared in clean room class 100 000

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100/100 000
- Facility crane

Activity Breakdown:
- Disconnect evacuation lines from PLM
- Connect PLM hoisting equipment
- Dismount PLM from Integration dolly
- Move PLM with crane in cleanroom class 100 000
- Install PLM in Test dolly. Z-axis mounted to test dolly!
- Reconnect evacuation equipment and continue evacuation

Personnel:
- Crane operator
- AIT engineer
- AIT technician
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:
n. a.

Activity Number:	E.050.020	**Duration:**	3 days
Activity Name:	Short functional Test (SFT) warm	**Model:**	EQM

Objective: SFT of cryo. control equipment

Requirements to be verified:

- functionality of instrumentation/equipment in warm condition

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in test dolly+ X-axis top

Activity Breakdown:

- Prepare check out equipment (Cryo SCOE)
- TRR
- Connect Cryo SCOE to PLM
- Start SFT

  Check functionality of PLM complete equipments/instrumentation
- PTR

Applicable Documents:

- PLM/EQM integration procedure
- PLM EGSE installation procedure
- SFT procedure in warm condition

GSE required:

- PLM test dolly
- Cryo SCOE

Facility instrumentation:

- Astrium OTN building 5.0; clean room class 100 000
- Check out area

Personnel:

- Electrical operation manager
- Electrical operator
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.050.030	**Duration:**	15 days
Activity Name:	Cool down and filling	**Model:**	

Objective: Cooldown and filling of main tank with He I

Requirements to be verified:

n.a.

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in test dolly
- Filling port installed and leaktest
- CVV evacuated
- Cryo SCOE connected and operational
- Strap pretension measurement devices mounted
-

Activity Breakdown:

- Install heavy duty access working platform
- Prepare CVSE equipment (Connect ventline, LHe dewars, LHe transferlines, flowmeter etc.)
- Prepare Cryostat configuration (LHe filling port, valve status etc.)
- Start cool down and filling
  - Leaktester connected in ventline of turbo pumps
  - Observe leakrate during cool down
- During cooldown increase strap pretension to 100%
- Prepare final configuration after filling (CVV evacuation, oscillation damper, valve status, filling port, transferlines, etc...)

Applicable Documents:

- Cool down and filling procedure for He I
- Procedure for preparation of transfer lines

GSE required:

- Cryo SCOE
- CVSE for filling operations (Transfer lines, ventline, LHe supply dewars, safety line to filling port etc.)
- Heavy duty access platform
- Leak tester
- PLM test dolly
- Evacuation equipment
- Strap pretension measurement equipment

Facility instrumentation:

- Astrium OTN building 5.0; clean room class 100 000
- Facility crane and standard hoisting slings

Personnel:

- Cryo operation manager
- Electrical operators
- Test conductor & engineer
- CVSE technician (vacuum serviceable)
- crane operator
- QA

Safety Precautions:

Standard safety precautions applicable

Special Notes:

n. a.

Activity Number: E.050.040 **Duration:** 2 days

Activity Name: Short functional test cold **Model:** EQM

Objective: SFT of cryo. control equipment in cold condition (He I)

Requirements to be verified:

- functionality of instrumentation/equipment in cold (He I) condition

Environment:

- temperature: (22 ± 3) °C
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in test dolly + X-axis top
- Main tank filled LHe I
- Cryo SCOE connected

Activity Breakdown:

- Prepare check out equipment (Cryo SCOE)
- TRR
- Start SFT

  Check functionality of PLM complete equipments/instrumentation
- PTR

Applicable Documents:

- PLM/EQM integration procedure
- SFT procedure in cold condition

GSE required:

- PLM test dolly
- Cryo SCOE

Facility instrumentation:

- Astrium OTN building 5.0; clean room class 100 000
- Check out area
- Cleanliness inspection equipment

Personnel:

- Electrical operation manager
- Electrical operator
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number: E.050.050 **Duration:** 10 days

Activity Name: He II production and He II top up of AXT **Model:** EQM

Objective: Production of He II in AXT

Requirements to be verified:
n.a.

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted test dolly
- Heavy duty access platform installed
- PLM main tank in He I condition (4,2 K)
- Ventline connected
- Filling port mounted
- Cryo SCOE connected

Activity Breakdown:

- Preparation CVSE (transferlines, dewar configuration, pumping units etc.)
- Prepare PLM status (actual state of main tank, connect pumping line, valve status, Cryo SCOE etc.)
- AXT He I filling
- AXT He II production
- AXT He II top up
- Complete AXT He II top up; prepare final configuration (check valve status, retract transferline and close filling port, stop He pumping unit I, remove supply- and transport dewar, continue pumping with He pumping unit II)

Applicable Documents:

- PLM EQM Integration procedure
- He I filling procedure
- He II production and top up procedure
- Procedure for preparation of transferlines

GSE required:

- Cryo SCOE
- CVSE for filling operations (He vacuum pumping unit I and II, Transferlines, LHe supply dewars etc.)
- Heavy duty working platform
- Leak tester
- PLM test dolly
- Safety line to filling port

Facility instrumentation:

- Astrium OTN building 5.0; clean room class 100 000
- Facility crane standard hoisting slings

Personnel:

- Cryo operation manager
- EGSE operator
- Test conductor
- CVSE technician (vacuum serviceable)
- QA

Safety Precautions:
Standard safety precautions for crane- and cryo operations are applicable

Special Notes:
n. a.

Activity Number:	E.050.060	**Duration:**	2 days
Activity Name:	Short functional test - He II conditions	**Model:**	EQM

Objective: SFT of cryo. control equipment in cold condition (He II)

Requirements to be verified:

- functionality of instrumentation/equipment in Cold (He II) condition

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in test dolly + X-axis top
- Main tank filled LHe I
- AXT filled with LHe II
- Cryo SCOE connected

Activity Breakdown:

- Prepare check out equipment (Cryo SCOE)
- TRR
- Start SFT

  Check functionality of PLM complete equipments/instrumentation
- PTR

Applicable Documents:

- PLM/EQM integration procedure
- SFT procedure in He II condition

GSE required:

- PLM integration dolly
- Standard hoisting slings
- Leaktest equipment

Facility instrumentation:

- Astrium OTN building 5.0; clean room class 100 000
- Check out area

Personnel:

- Electrical operation manager
- Electrical operator
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.250.070	**Duration:**	1 days
Activity Name:	Conversion to He I	**Model:**	EQM

Objective: conversion of AXT from He II in He I condition and depletion of AXT

Requirements to be verified:

n.a.

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:

- PLM mounted in test dolly. PLM +X-axis top.
- PLM main tank in He I condition (~ 4.2 K)
- PLM AXT in He II condition (< 2.14 K)
- He pumping unit II connected and running
- Cryo SCOE connected

Activity Breakdown:

- Stop He pumping unit II and disconnect
- Start AXT heating
- Connect ventline
- Depletion of AXT

Applicable Documents:

- PLM Depletion and warm up procedure

GSE required:

- Cryo SCOE
- PLM test dolly

Facility instrumentation:

- Astrium OTN building 5.0; clean room class 100000
- Facility crane

Personnel:

- Cryo. operation manager
- EGSE operator
- CVSE technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.050.080	**Duration:**	10 days
Activity Name:	Depletion and warm up	**Model:**	EQM

Objective: Warm up of cryostat

Requirements to be verified:

n.a.

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:

- PLM mounted in test dolly. PLM X-axis vertical. PLM +X-axis top.
- PLM main tank in He I condition (~ 4.2 K)
- PLM AXT empty
- Ventline installed
- Heavy duty access platform installed
- Strap pretension measurement devices mounted

Activity Breakdown:

- Install turbo pumps to PLM
- Start heating of main tank
- Start turbo pumps (if LHe level of main tank is ≤ 10 %) and check CVV isolation vacuum
- Start warm up of cryostat with GHe/GN2
- Decrease strap pretension during warm up phase to nom. value
- Disconnect ventline
- Dismount and store heavy duty platform
- Disconnect Cryo SCOE and cabling
- Disconnect and complete CVSE needs

Applicable Documents:

- PLM Depletion and warm up procedure

GSE required:

- Cryo SCOE
- PLM test dolly
- Strap pretension measurement device

Facility instrumentation:

- Astrium OTN building 5.0; clean room class 100 000
- Facility crane

Personnel:

- Cryo. operation manager
- EGSE operator
- CVSE technician
- AIT technician
- QA
- Crane operator

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.050.090	**Duration:**	2 days
Activity Name:	Transfer of PLM into clean room class 100	**Model:**	EQM

Objective: Move PLM in clean room class 100 and mounting in integration dolly.

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000/100

Configuration:
- PLM mounted in test dolly

Activity Breakdown:

- Install PLM hoisting device
- Separate PLM from test dolly
- Cleaning of PLM and hoisting device according class 100 requirements
- Move PLM by crane in clean room cl. 100
- Install PLM in integration dolly
- Disconnect hoisting device and remove

Applicable Documents:
- PLM Deintegration procedure

GSE required:
- PLM test dolly
- PLM integration dolly
- PLM hoisting device

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Facility crane
- Standard cleanliness/cleanliness inspection equipme

Personnel:
- Crane operator
- AIT engineer
- AIT technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:
n. a.

Activity Number:	E.060.010	**Duration:**	7 days
Activity Name:	Disassemble cryostat upper part	**Model:**	EQM

Objective: Pressurization of CVV to ambient pressure. De-integration of PLM upper cone and upper conical shields

Requirements to be verified:

n.a.

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly+ X-axis top
- CVV under vacuum
- Evacuation port mounted to CVV
- Cover closing plate mounted to upper bulkhead

Activity Breakdown:

- Mount CVV safety valve
- Installation of PLM pressurization line
- Pressurization of CVV to ambient pressure
- Dismount upper cone from CVV
  - Separate all interconnections to CVV inwards
- Dismount upper conical shields 1, 2, 3
  - Unseam MLI I/F's interm. shields/upper conic. Shields. Dismount LOU baffle
  - Disconnect shield instrumentation
- Temporary storage of H/W

Applicable Documents:

- PLM De-integration procedure

GSE required:

- PLM integration dolly
- standard hoisting slings
- GN2 supply (high-purity)

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:

- AIT engineer
- AIT technician (vacuum serviceable)
- MLI specialist
- Crane operator
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:

n. a.

Activity Number: E.060.020 **Duration:** 0,5 days

Activity Name: Disassemble OB template **Model:** EQM

Objective: De-integration of OB template

Requirements to be verified:
n.a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- PLM mounted in integration dolly+ X-axis top

Activity Breakdown:
- Disconnect OB template connection tube
- Dismount OB template from upper spatial framework and remove

Applicable Documents:
- PLM De-integration procedure

GSE required:
- PLM integration dolly
- standard hoisting slings

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:
- Crane operator
- AIT technician (1 vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:

n. a.

Activity Number:	E.060.030	**Duration:**	1 day
Activity Name:	Disassemble CVV Connector Ring	**Model:**	EQM

Objective: Demounting of CVV connector ring

Requirements to be verified:
n.a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- PLM mounted in integration dolly+ X-axis top

Activity Breakdown:
- Detach vacuum feedthrough connectors of PLM upper CCH from connector ring
- Detach OB outlet tube from V512
- Detach vacuum feedthrough connectors of CCH batch II from connector ring I/F
- Detach connector ring from CVV cyl. I/F and remove

Applicable Documents:
- PLM De-integration procedure

GSE required:
- PLM integration dolly
- standard hoisting slings

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:
- Crane operator
- AIT technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:

n. a.

Activity Number:	E.060.040	**Duration:**	2 days
Activity Name:	Disassemble intermediate thermal shields	**Model:**	EQM

Objective: Demounting of intermediate thermal shields

Requirements to be verified:
n.a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- PLM mounted in integration dolly - X-axis top

Activity Breakdown:
- Dismount successively intermediate shield 1,2,3
  - Unseam MLI I/F's cyl. therm. shields/ interm. therm. shields
- Dismount CCH batch II
- Temporary storage of H/W

Applicable Documents:
- PLM De-integration procedure

GSE required:
- PLM integration dolly

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class

Personnel:
- AIT technician
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.070.010	**Duration:**	5 days
Activity Name:	Preparation of OBA	**Model:**	EQM

Objective: Pre-assembly of OBA for integration

Requirements to be verified:
n.a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- OBA placed on adequate support
- OBA finally cleaned to class 100 cleanliness requirements

Activity Breakdown:

- Disassembly of OBA shield
- Disassemble OBA cable cut out covers
- Installation of temperature sensors to OBA
  - routing of sensor cabling
- Integration of harness fixings on OBA

Applicable Documents:
- PLM integration procedure
- OBA assembly drawing

GSE required:

- PLM integration dolly
- OBA shield hoisting device

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:

- Crane operator
- AIT technician
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:

n. a.

Activity Number: E.070.020 **Duration:** 7 days

Activity Name: Integration of OBA **Model:** EQM

Objective: Integration of optical bench assembly

Requirements to be verified:

- Leakrate of OB template connection tube I/F's $\leq 1x10^{-8}$ mbarls^{-1}

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly+ X-axis top
- OBA and LO links pre-assembled with temperature sensors. Harness fixings installed

Activity Breakdown:

- Final inspection of OBA
- Fianl inspection LO-thermal links
- Integration LO-thermal links to AXT
- Preintegration of OBA support brackets to OBA
- Mechanical installation of OBA to PLM upper spatial framework
- Mech. check: dimensions, screw torque, screw locking etc.
- Connect OBA tubing
- Perform leak check of OBA tubing I/F's

Applicable Documents:

- PLM integration procedure
- OBA assembly drawing

GSE required:

- PLM integration dolly
- OBA hoisting device
- Leaktest equipment

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:

- Crane operator
- AIT technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:

n. a.

Activity Number: E.070.030 **Duration:** 4 days

Activity Name: Integration of CCH batch III **Model:** EQM

Objective: Installation, routing and verification of PLM internal CCH III (upper part of CVV and OBA instrumentation)

Requirements to be verified:

- Circuit continuity of harness

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly -X-axis top

Activity Breakdown:

- Preparation of harness fixation areas
- Final inspection of internal CCH batch III
- Integration/Routing of CCH batch III
- Perform interconnections internal CCH batch III
- Electrical check out of CCH batch III

Applicable Documents:

- CCH batch III integration and verification procedure
- CCH batch III routing drawing

GSE required:

- PLM integration dolly
- Electrical check out equipment (IDAS)

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Cleaning-/Cleanliness inspection equipment

Personnel:

- AIT technician
- Harness technicians
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number: E.070.040 **Duration:** 10 days

Activity Name: Integration of SIH **Model:** EQM

Objective: Integration/Routing of SIH

Requirements to be verified:
- Circuit continuity of harness

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- PLM mounted in integration dolly -X-axis top
- OBA mounted to PLM and prepared for harness integration

Activity Breakdown:
- Preparation of harness fixation areas
- Final inspection of internal CCH batch III
- Integration/Routing of SIH up to CVV connector ring I/F

  -insert harness bundles in cut outs of OB and complete routing of bundles

  -fixation of harness bundles to structure
- Electrical check out of SIH after completion of harness integration

Applicable Documents:
- SIH integration and verification procedure
- SIH routing drawing

GSE required:
- PLM integration dolly
- Electrical check out equipment (IDAS)

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Cleaning-/Cleanliness inspection equipment

Personnel:
- AIT technician
- harness technicians
- QA

Safety Precautions:
Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.070.050	**Duration:**	1 day
Activity Name:	Preparation of CVV connector ring and intermediate thermal shields	**Model:**	EQM

Objective: Preparation of CVV connector ring for integration

Requirements to be verified:
n.a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- Connector ring placed on adequate support
- vacuum feedthrough connector blind plugs installed
- V512 installed

Activity Breakdown:

- Dismount vacuum feedthrough connector blind plugs
- Prepare MLI of intermediate thermal shields for integration (maintenance repairs after de-integration of shields)

Applicable Documents:

- Herschel PLM/EQM Integration procedure

GSE required:
- Standard hoisting slings

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:
- Crane operator
- AIT technician
- MLI specialist
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.070.060	**Duration:**	4 days
Activity Name:	Integration of CVV connector ring and intermediate thermal shields	**Model:**	EQM

Objective: Mechanical integration of intermediate thermal shields and CVV connector ring

Requirements to be verified:
- Leakrate of V512 tubing I/F ≤ $1x10^{-8}$ $mbarls^{-1}$

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- PLM mounted in integration dolly +X-axis top
- CVV connector ring preintegrated with V512
- Intermediate thermal shields preintegrated with MLI
- SIH installed to structure

Activity Breakdown:
- Final inspection of intermediate thermal shields
- Preinstall OB outlet tube
- Successive mechanical installation of intermediate thermal shield 1, 2, 3
  - Successive MLI Integration/Closure from intermediate shield 1, 2 and 3 to cyl. shield 1, 2, and 3
- Final inspection of CVV connector ring
- Integration of CVV connector ring
  - Connect V512 with OB outlet tube
  - Leaktest of I/F V512 to OB outlet tube

Applicable Documents:
- Herschel PLM/EQM Integration procedure

GSE required:
- PLM integration dolly
- Leak test equipment

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Cleaning-/Cleanliness inspection equipment
- Facility crane, standard hoisting slings

Personnel:
- Crane operator
- AIT technician (vacuum serviceable)
- Harness technicians
- MLI specialist
- QA

Safety Precautions:
Standard safety precautions for crane operations are applicable

Special Notes:
n. a.

Activity Number:	E.070.070	**Duration:**	15 days
Activity Name:	Integration of CCH and SIH vacuum connector feedthroughs in CVV connector ring and verification of harness after integration	**Model:**	EQM

Objective: Completion of SIH and CCH integration. Verification of SIH/CCH after completion

Requirements to be verified:

- Leakrate of vacuum feedthroug connector I/F's to CVV $\leq 1x10^{-8}$ mbarls^{-1}.
- Circuit continuity of harness

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly +X-axis top
- Intermediate thermal shields and CVV connector ring installed
- SIH/CCH installed to structure

Activity Breakdown:

- Final inspection of vacuum connector I/F areas
- Install SIH connector feedthroughs successively in CVV electrical ring
- Leak test of mounted SIH/CCH connector feedthroughs
- Final routing/fixation of harness
- Electrical check out of SIH/CCH after completion of integration

Applicable Documents:

- SIH integration and verification procedure
- SIH routing drawing

GSE required:

- PLM integration dolly
- Electrical check out equipment (IDAS)
- Leak test equipment
- Feed through connector evacuation cup

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Cleaning-/Cleanliness inspection equipment

Personnel:

- AIT technician (vacuum serviceable)
- Harness technicians
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:

n.a.

Activity Number: E.070.080 **Duration:** 1 day

Activity Name: KIP 2 **Model:** EQM

Objective: Review of EQM H/W status and corresponding documentation

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- PLM mounted in integration dolly

Activity Breakdown:
- Review of documentation:
  - CIDL/ CSL
  - As-built documentation status
  - NCR-status
  - Procedures and logsheet status
  - Open works
- Cleanliness status
- Hardware inspection
- Conclusion

Applicable Documents:
- Herschel EQM PLM documentation

GSE required:
n.a.

Facility instrumentation:
- Astrium OTN premises

Personnel:
- AIT engineer
- PLM S/S representative
- 1 PA

Safety Precautions:
n.a.

Special Notes:
n. a.

Activity Number: E.070.090 **Duration:** 12 days

Activity Name: Integration of instrument FPU's onto OBA **Model:** EQM

Objective: Mechanical integration of instrument FPU's onto OBA. Connecting of cooling straps

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100
- **ESD: personal ESD to be avoided**

Configuration:
- PLM mounted in integration dolly +X axis top

Activity Breakdown:
- Final inspection of instrument FPU's
- Preparation of FPU fixation areas on OBA
- Mechanical integration of instrument FPU's onto OB:
  - SPIRE FPU with SPIRE JFETS
  - PACS FPU
  - HIFI FPU
- Install groundings
- Check grounding of FPU QM's
- Connect thermal links to instrument FPU's
- Mech. check: dimensions, screw torque, screw locking etc.

Applicable Documents:
- Herschel EQM PLM Integration procedure
- SPIRE FPU integration procedure
- HIFI FPU integration procedure
- PACS FPU integration procedure

GSE required:
- PLM integration dolly
- Instrument specific lifting devices
- Working platform

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Facility crane
- Cleanliness inspection equipment

Personnel:
- Instruments representatives tbc.
- Crane operator
- AIT technician
- QA

Safety Precautions:
Standard safety precautions for crane operations are applicable

Special Notes:
- **ESD precautions are applicable**

Activity Number:	E.070.100	**Duration:**	9 days
Activity Name:	Connection and fixation of internal SIH to instruments	**Model:**	EQM

Objective: Final routing and connection of SIH to instrument FPU I/F's. Verification of harness after connection

Applicable Documents:
- SIH integration and verification procedure
- SIH routing drawing

Requirements to be verified:
- Circuit continuity of harness

GSE required:
- PLM integration dolly
- Working platform
- Electrical check out equipment (IDAS)

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100
- **ESD: personal ESD to be avoided**

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Cleaning-/Cleanliness inspection equipment

Configuration:
- PLM mounted in integration dolly.
- Instrument FPU's mechanical and thermal installed on OB

Personnel:
- Electrical engineer
- Electrical technician
- QA

Activity Breakdown:
- Connection of SIH I/F's at corresponding instrument FPU's I/F's
- Complete SIH fixation/routing on OB
- Electrical check of SIH (TBC)

Safety Precautions:

Standard safety precautions are applicable

Special Notes:
- **ESD precautions are applicable**

Activity Number: E.070.110 **Duration:** 1 day
Activity Name: KIP 3 **Model:** EQM

Objective: Review of EQM H/W status and corresponding documentation

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- PLM mounted in integration dolly

Activity Breakdown:
- Review of documentation:
  - CIDL/ CSL
  - As-built documentation status
  - NCR-status
  - Procedures and logsheet status
  - Open works
- Cleanliness status
- Hardware inspection
- Conclusion

Applicable Documents:
- Herschel EQM PLM documentation

GSE required:
n.a.

Facility instrumentation:
- Astrium OTN premises

Personnel:
- AIT engineer
- PLM S/S representative
- 1 PA

Safety Precautions:
n.a.

Special Notes:
n. a.

Activity Number: E.070.120 **Duration:** 3 days

Activity Name: Alignment HIFI (OBA) w.r.t. CVV windows **Model:** EQM

Objective: Alignment verification/adjustment of HIFI (OBA) w.r.t. CVV windows

Requirements to be verified:

- Alignment requirements of LOU w.r.t HIFI

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly
- OBA including FPU's and SIH completely integrated

Activity Breakdown:

- Install alignment equipment
- Alignment (adjustment) of HIFI (OBA) w.r.t. CVV windows
- Alignment control measurements
- Final torque and check of screw locking

Applicable Documents:

- PLM Alignment Procedure
- HIFI handling manual

GSE required:

- PLM integration dolly
- PLM alignment equipment/OGSE

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Cleaning-/Cleanliness inspection equipment

Personnel:

- Optical subsystem representative
- Alignment technicians
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number: E.070.130 **Duration:** 21 days

Activity Name: Instrument integration test **Model:** EQM

Objective: Electrical check of instrument FPU's after final integration on OB to verify integrity after installation

Requirements to be verified:

- According to instrument requirement specification

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100
- **ESD: personal ESD to be avoided**

Configuration:

- PLM mounted in integration dolly
- FPU's mounted on OBA and connected to SIH
- Instrument WU's connected via SVM SIH to CVV connectors

Activity Breakdown:

- Transfer of instrument WU into CR 100 on support panel
- TRR
- Connection of WU to CVV via SVM SIH
- Connection of Instrument EGSE
- Instrument integration test
- PTR
- Disconnection of instrument EGSE
- Disconnection of instrument WU from CVV connectors
- Transfer of instrument WU's to CR 100 000

Applicable Documents:

- Instrument Integration Test Procedure

GSE required:

- PLM integration dolly
- Electrical check out equipment of instruments (unit tester tbc)

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Check out area
- Cleaning-/Cleanliness inspection equipment

Personnel:

- instruments representatives
- check out operators
- electrical technician
- QA engineer

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

- **ESD precautions are applicable**

Activity Number:	E.070.140	**Duration:**	3 days
Activity Name:	Integration of OBA shield incl. instrumentation	**Model:**	EQM

Objective: Integration of OBA shield and related temperature sensors

Requirements to be verified:
Straylight requirements

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- Instrument FPU's integrated and aligned on OBA

Activity Breakdown:
- Final inspection and final cleaning of OBA shield
- Mechanical installation of OB shield
- Connect sensor harness and perform electrical check
- Closing of OBA shield MLI and check of MLI bonding
- Verify straylight tightness
- Mech. check: dimensions, screw torque, screw locking etc.

Applicable Documents:
- Herschel EQM PLM Integration procedure
- MLI integration procedure

GSE required:
- PLM integration dolly
- Working platform
- OB shield lifting device

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Facility crane
- Cleanliness inspection equipment

Personnel:
- Crane operator
- AIT technician
- Electrical technician
- MLI specialist
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:
n.a.

Activity Number: E.070.150 **Duration:** 6 days

Activity Name: Preparation of upper bulkhead **Model:** EQM

Objective: Preparation of upper bulkhead for integration

Requirements to be verified:

- Leakrate of LOU window I/F's to CVV ≤ $1x10^{-8}$ $mbarls^{-1}$

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- Upper bulkhead placed on adequate support
- LOU window blind caps installed to upper bulkhead
- Cover closing plate mounted to upper bulkhead
  - SV921/922 mounted to upper bulkhead

Activity Breakdown:

Preparation of upper bulkhead for integration

- Dismount LOU window blind caps
- Final inspection of upper bulkhead and LOU window 's
- Installation of LOU windows
- Leaktest of LOU windows

Applicable Documents:

- Herschel PLM/EQM Integration procedure
- Upper bulkhead assembly drawing

GSE required:

- standard hoisting slings
- Leak test equipment
- LOU window Special evacuation cup

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:

- crane operator
- AIT technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.070.160	**Duration:**	15 days
Activity Name:	Integrate Cryostat upper part (thermal shields and upper bulkhead	**Model:**	EQM

Objective: Integration of upper conical shield and upper bulkhead

Requirements to be verified:

- Leakrate of fill/vent tube I/F to upper cone $\leq 1x10^{-8}$ mbarls^{-1}

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly -X-axis top
- CVV upper bulkhead plate (I/F to cry. cover) pre-integrated to upper bulkhead

Activity Breakdown:

- Inspection PLM upper part
- Final cleaning and final inspection of upper therm. shields and upper bulkhead
- Successive interconnection of upper shield 1, 2, 3 inclusive cover- and LOU baffle
  - Successive interconnection of shield instrumentation cabling from upper shield 1, 2 and 3 to cyl. Shield 1, 2, and 3
  - Perform electrical check of shield instrumentation after each plug connection
  - Successive MLI closure (upper therm. shields to cyl. therm shields)
- Integration of upper cone and connection of fill vent tube

Activity breakdown (cont'd)

- Perform leak check of fill/vent tube I/F to upper cone
- Mech. Check dimensions screw torque, screw locking etc.

Applicable Documents:

- PLM/EQM integration procedure
- Assembly drawing PLM upper part

GSE required:

- PLM integration dolly
- standard hoisting slings
- Leaktest equipment
- Circuit continuity measurement equipment

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:

- crane operator
- AIT technician (vacuum serviceable)
- electrical technician
- MLI specialist
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:

n. a.

Activity Number: E.070.170 **Duration:** 5 days

Activity Name: Integration and alignment of LOU **Model:** EQM

Objective: Integration of LOU support structure and LOU onto CVV. Alignment of LOU vs. HIFI

Requirements to be verified:

- Alignment requirements of LOU w.r.t. HIFI

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly
- Internal PLM integration completed

Activity Breakdown:

- Preparation of fixation areas
- Integrate LOU support structure
- Mechanical mounting of LOU
- Electrical integration of LOU
- Mount waveguides
- Mech. check: dimensions, screw torque, screw locking etc.
- Check grounding
- Install alignment equipment
- Alignment of LOU w.r.t. HIFI (open cover)

Applicable Documents:

- PLM Integration procedure
- LOU handling manual

GSE required:

- PLM integration dolly
- PLM alignment equipment/OGSE
- Working platform
- LOU lifting device

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Cleaning-/Cleanliness inspection equipment

Personnel:

- Optical subsystem representative
- Alignment technicians
- QA
- Crane operator

Safety Precautions:

Standard safety precautions to crane operations are applicable

Special Notes:

n.a.

Activity Number:	E.070.180	**Duration:**	1 day
Activity Name:	MIP 2	**Model:**	EQM

Objective: Review of H/W status and corresponding documentation

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- PLM mounted in integration dolly

Activity Breakdown:
- Review of documentation:
  - CIDL/ CSL
  - As-built documentation status
  - NCR-status
  - Procedures and logsheet status
  - Open works
- Cleanliness status
- Hardware inspection
- Conclusion

Applicable Documents:
- Herschel PLM EQM documentation

GSE required:
-

Facility instrumentation:
- Astrium OTN premises

Personnel:
- AIT engineer
- PLM S/S representative
- Customer representatives
- PA

Safety Precautions:
n.a.

Special Notes:
n. a.

Activity Number:	E.070.190	**Duration:**	2 days
Activity Name:	Integration of Cryostat Cover	**Model:**	EQM

Objective: Mounting of cryostat cover (without baffle) to close cryostat

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- PLM mounted in integration dolly+ X-axis top
- CVV upper bulkhead plate (I/F to cryostat cover) preinstalled to upper cone

Activity Breakdown:
- Final inspection of cryostat cover and CVV I/F
- Install sealing for cover I/F
- Mechanical installation of cryostat cover components
- Installation of cover harness and electr. check
- Mech. check: dimensions, screw torque, screw locking etc.

Applicable Documents:
- PLM/EQM integration procedure
- CVV/Cryostat cover assembly drawing
- Cover handling manual

GSE required:
- PLM integration dolly
- Scaffolding
- Cover lifting device
- Electrical check out equipment (IDAS)

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Facility crane
- Standard cleaning equipment

Personnel:
- crane operator
- 2AIT technician
- QA engineer
- IDAS operator

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:

n. a.

Activity Number: E.070.200 **Duration:** 6 days

Activity Name: PLM evacuation and leaktest **Model:** EQM

Objective: Evacuation of PLM and verification of CVV- and internal He subsystem leak tightness

Requirements to be verified:

- local leakrates $\leq 1x10^{-8}$ mbarls^{-1}
- global leakrate $\leq 10x10^{-6}$ mbarls^{-1}

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM/EQM mounted in integration dolly
- CVV finally closed

Activity Breakdown:

- Integration of SV121 airlock
- Integration of CVV evacuation port
- Connect evacuation equipment to evacuation port (leaktester connected parallel behind turbo pump)
- Leak check of evacuation line
- Evacuate PLM vacuum vessel (controlled evacuation, to avoid instrument and MLI damage)
- Perform integral leak check of He-subsystem against inner vessel
- Perform local leak check of CVV O-ring seals:
  - lower bulkhead
  - upper cone I/F's
  - connector ring
  - cover closing plate I/F to CVV

  against ambient

Activity Breakdown: (cont'd)

- Perform local leak check of filling port I/F to upper cone
- Perform local leak check of upper cone safety valve I/F's to upper cone.

Perform local leak check of V 512 I/F to upper cone

Applicable Documents:

- Herschel EQM PLM Integration procedure
- CVSE installation drawing

GSE required:

- PLM integration dolly
- Leaktest equipment
- PLM evacuation lines
- PLM evacuation equipment (Turbo pump and High vacuum pumping unit)

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Standard cleaning equipment

Personnel:

- 1 crane operator
- AIT/CVSE technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.070.210	**Duration:**	2 days
Activity Name:	Move PLM in clean room class 100 000	**Model:**	EQM

Objective: Dismounting of PLM from Integration dolly, movement in clean room class 100 000 and reinstallation in test dolly

Requirements to be verified:

n. a.

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 and class 100 000

Configuration:

- PLM mounted in integration dolly.
- PLM under vacuum and successfully leak tested
- Test dolly prepared in clean room class 100 000

Activity Breakdown:

- Disconnect evacuation lines from PLM
- Connect PLM hoisting equipment
- Dismount PLM from Integration dolly
- Move PLM with crane in cleanroom class 100 000
- Install PLM in Test dolly. Z-axis mounted to test dolly
- Reconnect evacuation equipment and continue evacuation

Applicable Documents:

- PLM/EQM integration procedure
- PLM hoisting equipment handling manual
- PLM Test dolly handling manual

GSE required:

- PLM integration dolly
- PLM hoisting equipment
- PLM test dolly (SN03, expanded in width)
- Working Platform

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100/100 00
- Facility crane

Personnel:

- Crane operator
- AIT engineer
- AIT technician
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:

n. a.

Activity Number:	E.080.010	**Duration:**	3 day
Activity Name:	Integration of PLM onto SVM simulator	**Model:**	EQM

Objective: Mating of PLM with SVM simulator

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:
- PLM mounted in test dolly
- SVM simulator (with integrated WU's) prepared for mating with PLM

Activity Breakdown:
- Dismount PLM from test dolly
- Mating of PLM with SVM simulator
- Reinstallation of PLM/SVM in test dolly
- Mech. check: dimensions, screw torque, screw locking etc

Applicable Documents:
- PLM Integration procedure
- PLM/SVM assembly drawing

GSE required:
- PLM test dolly
- PLM hoisting equipment

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100 000
- Facility crane

Personnel:
- AIT engineer
- Crane operator
- AIT technician
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:
n.a.

Activity Number: E.080.020 **Duration:** 15 days

Activity Name: Integration of external SIH **Model:** EQM

Objective: Integration/Routing of external SIH to PLM structure and connection to WU's

Requirements to be verified:

- Circuit continuity of harness

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000
- ESD: personal ESD to be avoided

Configuration:

- PLM with SVM simulator mounted in test dolly

Activity Breakdown:

- Preparation of SIH fixation areas
- Installation and routing of SIH at PLM outer structure
- Connection of external SIH to corresponding vacuum feedthrough I/F's
- Connection of SIH to corresponding harness interconnection brackets on SVM simulator
- Connection to WU's
- Electrical check out of SIH after plug connection

Applicable Documents:

-
- PLM Integration procedure
- SIH integration and verification procedure
- SIH routing drawing

GSE required:

- PLM test dolly
- Electrical check out equipment (IDAS)

Facility instrumentation:

- Astrium OTN building 5.0; clean room class 100 000
- Cleanliness inspection equipment

Personnel:

- Electrical engineer
- Electrical technician
- AIT technician
- QA engineer

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

ESD precautions applicable

Activity Number: E.080.030 **Duration:** 2 days

Activity Name: Integration of waveguides **Model:** EQM

Objective: Completion of waveguides assembly

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:
- PLM with SVM simulator mounted in test dolly
- LOU mounted to PLM

Activity Breakdown:
- Mounting of waveguides to structure
- Adjustment/Alignment of waveguides
- Mech. check: dimensions, screw torque, screw locking etc.

Applicable Documents:
- PLM Integration procedure
- Waveguide handling manual

GSE required:
- PLM test dolly
- Working platform

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Cleanliness inspection equipment

Personnel:
- Optical subsystem representative
- AIT engineer
- AIT technician
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:
n.a.

Activity Number:	E.080.040	**Duration:**	2 days
Activity Name:	Connect CVSE – continue evacuation	**Model:**	EQM

Objective: Reinstallation of CVSE evacuation equipment to CVV and continue evacuation

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:
- PLM with SVM simulator mounted in test dolly
- PLM evacuation I/F already mounted and leaktested, evacuation lines preinstalled and leaktested
- CVV pre-evacuated

Activity Breakdown:
- Connect evacuation equipment to evacuation port
- Perform leak check of evacuation line and evacuation port
- Continue PLM evacuation

Applicable Documents:
- PLM/EQM integration procedure
- CVSE installation drawing

GSE required:
- PLM test dolly
- Leaktest equipment
- PLM evacuation lines
- PLM evacuation equipment (Turbo pump and High vacuum pumping unit)

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Standard cleaning equipment

Personnel:
- AIT/CVSE technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions for are applicable

Special Notes:

n. a.

Activity Number:	E.080.050	**Duration:**	7days
Activity Name:	Short functional Test (SFT) warm	**Model:**	EQM

Objective: Connection of cryo SCOE and instrument MGSE,
SFT of cryo. control equipment,
health check of instruments

Requirements to be verified:

- functionality of instrumentation/equipment, PLM MGSE and instruments in cold (He I) condition

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 00

Configuration:

- PLM with SVM simulator mounted in test dolly
- Instrument FPU's and instrument warm units integrated

Activity Breakdown:

- Prepare check out equipment (Cryo SCOE) and PLM instrument EGSE
- TRR
- Connect cryo SCOE
- Connect Instrument EGSE
- Start SFT
  - Check functionality of PLM complete equipments/instrumentation and health check instruments
- PTR

Applicable Documents:

- PLM/EQM integration procedure
- PLM EGSE installation procedure
- SFT procedure in warm condition

GSE required:

- PLM test dolly
- PLM EGSE check out equipment
- Cryo SCOE
- Instrument EGSE

Facility instrumentation:

- Astrium OTN building 5.0; clean room class 100 000
- Check out area

Personnel:

- Electrical operation manager
- Instruments representatives
- Electrical operator
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.080.060	**Duration:**	15 days
Activity Name:	Cooldown and filling	**Model:**	EQM

Objective: Cooldown and filling of main tank with He I

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:
- PLM with SVM simulator mounted in test dolly
- Filling port installed and leaktest
- CVV evacuated
- Cryo SCOE connected and operational
- Strap pretension measurement devices mounted

Activity Breakdown:

- Install heavy duty access working platform
- Prepare CVSE equipment (Connect ventline, LHe dewars, LHe transferlines, flowmeter etc.)
- Prepare Cryostat configuration (LHe filling port, valve status etc.)
- Start cool down and filling. Respect cooling requirements of instruments.
  - Leaktester connected in ventline of turbo pumps
  - Observe leakrate during cool down
- During cooldown increase strap pretension to 100% under respect of OB alignment requirements
- Prepare final configuration after filling (CVV evacuation, oscillation damper, valve status, filling port, transferlines, etc...)

Applicable Documents:
- Cool down and filling procedure for He I
- Procedure for preparation of transfer lines

GSE required:
- Cryo SCOE
- CVSE for filling operations (Transfer lines, ventline, LHe supply dewars, safety line to filling port etc.)
- Heavy duty access platform
- Leak tester
- PLM test dolly
- Evacuation equipment
- Strap pretension measurement equipment

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Facility crane and standard hoisting slings

Personnel:
- Cryo operation manager
- Electrical operators
- Test conductor & engineer
- CVSE technician (vacuum serviceable)
- crane operator
- QA

Safety Precautions:
Standard safety precautions for are applicable

Special Notes:
n.a

Activity Number:	E.080.070	**Duration:**	2 days
Activity Name:	Short functional test (SFT) cold SFT	**Model:**	EQM

Objective: SFT of cryo. control equipment in cold condition (He I), health check of instruments after He I filling

Requirements to be verified:

- functionality of instrumentation/equipment and instruments in cold (He I) condition
-

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM with SVM simulator mounted in test dolly
- Main tank filled LHe I
- PLM EGSE connected

Activity Breakdown:

- Prepare check out equipment (Cryo SCOE) and PLM instrument EGSE
- TRR
- Start SFT

  Check functionality of PLM complete equipments/instrumentation and health check of instruments
- PTR

Applicable Documents:

- PLM/EQM integration procedure
- SFT procedure in cold condition

GSE required:

- PLM test dolly
- Cryo SCOE
- Instrument EGSE

Facility instrumentation:

- Astrium OTN building 5.0; clean room class 100 000
- Check out area

Personnel:

- Test conductor & engineer
- Instruments representatives
- Electrical operation manager
- Electrical operator
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number: E.080.080 **Duration:** 10 days

Activity Name: He II production and He II top up of AXT **Model:** EQM

Objective: Production of He II in AXT

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:
- PLM with SVM simulator mounted in test dolly
- Heavy duty access platform installed
- PLM main tank in He I condition (4,2 K)
- Ventline connected
- Filling port mounted
- Cryo SCOE connected

Activity Breakdown:
- Preparation CVSE (transferlines, dewar configuration, pumping units etc.)
- Prepare PLM status (actual state of main tank, connect pumping line, valve status, Cryo SCOE etc.)
- AXT He I filling
- AXT He II production
- AXT He II top up
- Complete AXT He II top up; prepare final configuration (check valve status, retract transferline and close filling port, stop He pumping unit I, remove supply- and transport dewar, continue pumping with He pumping unit II)

Applicable Documents:
- PLM EQM Integration procedure
- He I filling procedure
- He II production and top up procedure
- Procedure for preparation of transferlines

GSE required:
- Cryo SCOE
- CVSE for filling operations (He vacuum pumping unit I and II, Transferlines, LHe supply dewars etc.)
- Heavy duty working platform
- Leak tester
- PLM test dolly
- Safety line to filling port

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Facility crane standard hoisting slings

Personnel:
- Cryo operation manager
- EGSE operator
- Test conductor
- CVSE technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions for crane- and cryo operations are applicable

Special Notes:

n. a.

Activity Number:	E.080.090	**Duration:**	2 days
Activity Name:	Short functional test - He II conditions	**Model:**	EQM

Objective: SFT of cryo. control equipment in cold condition (He II), health check of instruments after He II filling

Requirements to be verified:

- functionality of instrumentation/equipment and instruments in Cold (He II) condition

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM with SVM simulator mounted in test dolly, + X-axis top
- Main tank filled LHe I
- AXT filled with LHe II
- PLM EGSE connected

Activity Breakdown:

- Prepare check out equipment (Cryo SCOE)
- TRR
- Start SFT

  Check functionality of PLM complete equipments/instrumentation and health check of instruments
- PTR

Applicable Documents:

- PLM/EQM integration procedure
- SFT procedure in He II condition

GSE required:

- PLM test dolly
- Cryo SCOE
- Instrument EGSE

Facility instrumentation:

- Astrium OTN building 5.0; clean room class 100 000
- Check out area

Personnel:

- Test conductor & engineer
- Instruments representatives
- Electrical operation manager
- Electrical operator
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.080.090	**Duration:**	2 days
Activity Name:	Preparation of set-up for cover flushing	**Model:**	EQM

Objective: Provide configuration to perform cover flushing

Requirements to be verified:
Leak tightness of

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000
- ESD: personal ESD to avoided

Configuration:
- PLM with SVM simulator mounted in test dolly, + X-axis top
- Main tank filled LHe I
- AXT filled with LHe II
- Cryo SCOE connected
- Cover baffle mounted to cryo cover

Activity Breakdown:

- Preparation of cover flushing equipment and access platform
- Positioning cover flushing supply dewar
- Installation of cover flushing lines (inlet/outlet) to cryo cover I/F's
- Leaktest of installed cover flushing lines

Applicable Documents:

- PLM/EQM integration procedure
- Cover flushing equipment installation procedure

GSE required:
- PLM test dolly
- Leaktest equipment

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Facility crane standard hoisting slings

Personnel:
- CVSE technician (vacuum serviceable)
- QA

Safety Precautions:
Standard safety precautions are applicable

Special Notes:
n. a.

Activity Number:	E.090.010	**Duration:**	5 days
Activity Name:	Cryostat tests (CCU and instrumentation)	**Model:**	EQM

Objective: to verify correct operation of cryostat with Cryo SCOE

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:
- PLM with SVM simulator mounted in test dolly
- PLM main tank filled with He I and venting via V502
- PLM AXT filled with He II and venting via V512. He II pumping unit running
- Cryo SCOE connected and operational
- CCS connected to cryo SCOE and operational (TBC) See E.200.010

Activity Breakdown:
- Preparation of Test
- TRR
- Perform cryostat tests with cryo SCOE and cryo. instrumentation
- Tilt Cryostat according instrument needs
- PTR

Applicable Documents:

- Cryostat instrumentation Test procedure

GSE required:
- PLM test dolly
- CCS tbc.
- Cryo SCOE

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Check out area

Personnel:
- Cryo. operation manager
- EGSE operators
- electrical engineer
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.090.020	**Duration:**	10 days
Activity Name:	HIFI tests	**Model:**	EQM

Objective: Functional and performance verification of the instrument HIFI

Requirements to be verified:
- According HIFI functional and performance test procedure

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:
- PLM with SVM simulator mounted in test dolly
- PLM main tank filled with He I
- PLM AXT filled with He II
- EGSE set-up installed and tested

Activity Breakdown:
- Prepare HIFI IMT configuration
- TRR
- Perform HIFI IMT
- Tilt Cryostat according instrument needs
- PTR

Specific Constraints:
- Cryo cover requirements

Applicable Documents:
- HIFI Integrated Module Test (IMT) procedure

GSE required:
- PLM test dolly
- CCS (Central Check-out system)

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Check out area

Personnel:
- IMT operation manager
- HIFI instrument representative
- Cryo. operation manager
- EGSE operators
- AIT technician (vacuum serviceable)
- QA

Safety Precautions:
Standard safety precautions are applicable

Special Notes:
n. a.

Activity Number:	E.090.030	**Duration:**	10 days
Activity Name:	PACS Tests	**Model:**	EQM

Objective: Functional and performance verification of the instrument PACS

Requirements to be verified:
- According PACS functional and performance test procedure

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:
- PLM with SVM simulator mounted in test dolly
- PLM main tank filled with He I
- PLM AXT filled with He II
- EGSE set-up installed and tested

Activity Breakdown:
- Prepare PACS IMT configuration
- TRR
- Perform PACS IMT
- Tilt Cryostat according instrument needs
- PTR

Specific Constraints:
- Tilting and thermal requirements
- Cryo cover requirements

Applicable Documents:
- PACS Integrated Module Test (IMT) procedure

GSE required:
- PLM test dolly
- CCS (Central Check-out system)

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Check out area

Personnel:
- IMT operation manager
- PACS instrument representative
- Cryo. operation manager
- EGSE operators
- AIT technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:

n. a.

Activity Number:	E.090.040	**Duration:**	10 days
Activity Name:	SPIRE tests	**Model:**	EQM

Objective: Functional and performance verification of the instrument SPIRE

Requirements to be verified:
- According SPIRE functional and performance test procedure

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:
- PLM with SVM simulator mounted in test dolly
- PLM main tank filled with He I
- PLM AXT filled with He II
- EGSE set-up installed and tested

Activity Breakdown:
- Prepare SPIRE IMT configuration
- TRR
- Perform SPIRE IMT
- Tilt Cryostat according instrument needs
- PTR

Specific Constraints:
- Tilting and thermal requirements
- Cryo cover requirements

Applicable Documents:
- SPIRE Integrated Module Test (IMT) procedure

GSE required:
- PLM test dolly
- CCS (Central Check-out system)

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Check out area

Personnel:
- IMT operation manager
- SPIRE instrument representative
- Cryo. operation manager
- EGSE operators
- AIT technician (vacuum serviceable)
- QA

Safety Precautions:
Standard safety precautions are applicable

Special Notes:
n. a.

Activity Number:	E.090.050	**Duration:**	10 days
Activity Name:	PACS/SPIRE tests (parallel mode)	**Model:**	EQM

Objective: Test of PACS/SPIRE in parallel mode

Requirements to be verified:
- According to test procedure PACS/SPIRE in parallel mode

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:
- PLM with SVM simulator mounted in test dolly
- PLM main tank filled with He I
- PLM AXT filled with He II
- EGSE set-up installed and tested

Activity Breakdown:
- Prepare PACS/SPIRE parallel mode test configuration
- TRR
- Perform PACS/SPIRE IMT
- Tilt Cryostat according instrument needs
- PTR

Specific Constraints:
- Tilting and thermal requirements
- Cryo cover requirements

Applicable Documents:
- PACS/SPIRE (parallel mode) Integrated Module Test (IMT) procedure

GSE required:
- PLM test dolly
- CCS (Central Check-out system)

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Check out area

Personnel:
- IMT operation manager
- SPIRE instrument representative
- Cryo. operation manager
- EGSE operators
- AIT technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:
n. a.

Activity Number: E.090.060 **Duration:** 20 days

Activity Name: EMC Tests (RS) **Model:** EQM

Objective: EMC tests with instruments

Requirements to be verified:

- According EMC requirement specification AD 07

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:

- PLM with SVM simulator mounted in test dolly
- PLM main tank filled with He I
- PLM AXT filled with He II
- EGSE set-up installed and tested

Activity Breakdown:

- Prepare/Install test configuration for EMC testing of instruments
- TRR
- Perform EMC testing of instruments (RS):
  - HIFI tests
  - PACS tests
  - SPIRE tests
  - PACS/SPIRE tests (parallel mode)
- PTR

Applicable Documents:

- PLM EMC Test Procedure

GSE required:

- PLM test dolly
- CCS (Central Check-out system)
- EMC (~~CS, CE and~~ RS) test equipment

Facility instrumentation:

- Astrium OTN building 5.0; clean room class 100 000
- Check out area

Personnel:

- EMC measurement team
- AIT test conductor
- instrument representative
- EGSE/CCS operators
- AIT technician (vacuum serviceable)
- QA

Safety Precautions:

- Standard safety precautions are applicable
- Standard safety precautions for electro-magnetic pulse (EMI) are applicable

Special Notes:

n. a.

Activity Number:	E.090.070	**Duration:**	1 day
Activity Name:	Conversion to He I	**Model:**	EQM

Objective: Conversion of AXT from He II in He I condition and depletion of AXT

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:
- PLM with SVM simulator mounted in test dolly. PLM +X-axis top.
- PLM main tank in He I condition (~ 4.2 K)
- PLM AXT in He II condition (< 2.14 K)
- He pumping unit II connected and running
- Cryo SCOE connected

Activity Breakdown:

- Stop He pumping unit II and disconnect
- Start AXT heating
- Connect ventline
- Depletion of AXT

Applicable Documents:
- PLM Depletion and warm up procedure

GSE required:
- Cryo SCOE
- PLM test dolly

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Facility crane

Personnel:
- Cryo. operation manager
- EGSE operator
- CVSE technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:
n. a.

Activity Number:	E.090.080	**Duration:**	8 days
Activity Name:	Depletion and warm up	**Model:**	EQM

Objective: Warm up of cryostat

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:
- PLM with SVM simulator mounted in test dolly. +X -axis top.
- PLM main tank in He I condition (~ 4.2 K)
- PLM AXT empty
- Ventline installed
- Heavy duty access platform installed
- Strap pretension measurement devices mounted

Activity Breakdown:

- Install turbo pumps to PLM
- Start heating of main tank
- Start turbo pumps (if LHe level of main tank is ≤ 10 %) and check CVV isolation vacuum
- Start warm up of cryostat with GHe/GN2
- Decrease strap pretension during warm up phase to nom. value
- Disconnect ventline
- Dismount and store heavy duty platform
- Disconnect Cryo SCOE and cabling
- Disconnect and complete CVSE needs

Applicable Documents:
- PLM Depletion and warm up procedure

GSE required:
- Cryo SCOE
- PLM test dolly
- Strap pretension measurement device

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Facility crane

Personnel:
- Cryo. operation manager
- EGSE operator
- CVSE technician
- AIT technician
- QA
- Crane operator

Safety Precautions:

Standard safety precautions are applicable

Special Notes:
n. a.

Activity Number: E.100.010 **Duration:** 5 days

Activity Name: Dismounting of waveguides and external SIH **Model:** EQM

Objective: De-integration of waveguides and external SIH from PLM structure

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000
- ESD: personal ESD to be avoided

Configuration:
- PLM with SVM simulator mounted in test dolly

Activity Breakdown:
- Separate all interconnections (SIH and waveguides) between PLM and SVM
- Dismount waveguides
- Dismount SIH

Applicable Documents:
- PLM Deintegration procedure

GSE required:
- PLM test dolly
- Waveguide and SIH storage boxes

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000

Personnel:
- Electrical engineer
- Electrical technician
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:
- ESD precautions applicable

Activity Number:	E.100.020	**Duration:**	2 days
Activity Name:	Demating of SVM simulator	**Model:**	EQM

Objective: De-mating of SVM simulator from PLM structure

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:
- PLM with SVM simulator mounted in test dolly

Activity Breakdown:

- Dismount PLM from test dolly
- De-mating of PLM with SVM simulator
- Reinstallation of PLM/SVM in test dolly
- Dismount LOU
- Dismount SV121 airlock
- Mech. check: dimensions, screw torque, screw locking etc

Applicable Documents:

- PLM Deintegration procedure

GSE required:
- PLM test dolly
- PLM hoisting equipment

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Facility crane

Personnel:
- AIT engineer
- Crane operator
- AIT technician
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:
n. a.

Activity Number:	E.100.030	**Duration:**	2 days
Activity Name:	De-integration of warm units	**Model:**	EQM

Objective: Dismounting and storage of warm units from SVM simulator

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000
- ESD: personal ESD to be avoided

Configuration:
- SVM simulator separated from PLM

Activity Breakdown:
- Separate all interconnections between WU and SVM simulator structure
- Preparation/provision of WU transport /storage boxes
- Dismount WU from SVM simulator structure
- Install WU's in transport/storage containers

Applicable Documents:
- PLM Deintegration procedure
- Warm units handling manual

GSE required:
- WU's transport /storage containers

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Facililty crane, standard hoisting slings

Personnel:
- Electrical technician
- AIT technician
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:
- ESD precautions applicable

Activity Number:	E.100.040	**Duration:**	4 days
Activity Name:	Packing of WU's for Transport	**Model:**	EQM

Objective: Packing of instrument WU's for transport to Alenia

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000

Configuration:

- WU's dismounted from SVM simulator structure

Activity Breakdown:
- Final inspection of WU's
- Packing of WU's in transport containers
- Organization of transport

Applicable Documents:

- PLM Deintegration procedure
- WU's handling/transport and procedure

GSE required:
- WU transport containers
- Standard cleanliness equipment

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Facililty crane, standard hoisting slings

Personnel:
- Electrical technician
- AIT technician
- QA

Safety Precautions:
Standard safety precautions are applicable

Special Notes:

n.a.

Activity Number: E.100.050 **Duration:** 2 days

Activity Name: Transfer of PLM into clean room class 100 **Model:** EQM

Objective: Move PLM in clean room class 100 and mounting in integration dolly.

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000/100

Configuration:
- PLM mounted in test dolly place in clean room class 100 000
- PLM Integration dolly placed in clean cabin cl. 100

Activity Breakdown:
- Install PLM hoisting device
- Separate PLM from test dolly
- Cleaning of PLM and hoisting device according class 100 requirements
- Move PLM by crane in clean room cl. 100
- Install PLM in integration dolly
- Disconnect hoisting device and remove

Applicable Documents:
- PLM Deintegration procedure

GSE required:
- PLM test dolly
- PLM integration dolly
- PLM hoisting device

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000, class100
- Facility crane
- Standard cleanliness/cleanliness inspection equipme

Personnel:
- Crane operator
- AIT engineer
- AIT technician
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:
n.a.

Activity Number: E.100.060 **Duration:** 6 days

Activity Name: Disassemble cryostat upper part **Model:** EQM

Objective: Pressurization of CVV to ambient pressure. De-integration of PLM upper cone and upper conical shields

Requirements to be verified:

n.a.

Environment:

- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100

Configuration:

- PLM mounted in integration dolly
- CVV under vacuum
- Evacuation port mounted to CVV
- Cryostat Cover mounted to upper bulkhead

Activity Breakdown:

- Mount CVV safety valve
- Installation of PLM pressurization line
- Pressurization of CVV to ambient pressure
- Dismount upper cone from CVV
  - Separate all interconnections to CVV inwards
- Dismount upper conical shields 1, 2, 3
  - Unseam MLI I/F's interm. shields/upper conic. Shields. Dismount LOU baffle
  - Disconnect shield instrumentation
- Temporary storage of H/W

Applicable Documents:

- PLM De-integration procedure

GSE required:

- PLM integration dolly
- standard hoisting slings
- GN2 supply (high-purity)

Facility instrumentation:

- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:

- AIT engineer
- AIT technician (vacuum serviceable)
- MLI specialist
- Crane operator
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:

n. a.

Activity Number:	E.100.070	**Duration:**	12 days
Activity Name:	Dismounting of instrument FPU's	**Model:**	EQM

Objective: Dismounting of instruments from OBA

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100
- ESD: personal ESD to be avoided

Configuration:
- PLM mounted in integration dolly
- PLM upper part dismounted

Activity Breakdown:

- Dismount OBA thermal shield
- Disconnect SIH from FPU's
- Disconnect thermal straps
- Dismount instruments from OB:
  - HIFI
  -PACS
  -SPIRE and SPIRE J-FETS
- Install FPU's in transport containers

Applicable Documents:

- PLM Deintegration procedure
- FPU's handling manual
- FPU's transport/storage procedure

GSE required:
- PLM integration dolly
- FPU's lifting devices
- FPU's transport containers

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100
- Facility crane

Personnel:
- Instrument representative
- AIT engineer
- AIT technician
- electrical technician
- QA

Safety Precautions:
Standard safety precautions are applicable

Special Notes:

- ESD precautions applicable

Activity Number:	E.100.080	**Duration:**	23 days
Activity Name:	Remounting of PLM for Storage	**Model:**	EQM

Objective: Remounting of cryostat for storage after Instrument demounting

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100/100 000

Configuration:
- PLM mounted in integration dolly
- Instrument FPU's demounted

Activity Breakdown:
- Integration of OBA shield and instrumentation
- Integration of upper therm. shields (incl. instrumentation LOU baffle and MLI)
- Integration of upper bulkhead incl. all interconnections
- Integration of cover closing plate
- Connection of evacuation equipment
- Evacuation and leaktest of CVV
- Move PLM in cleanroom cl. 100 000

Applicable Documents:
- PLM Deintegration procedure

GSE required:
- PLM hoisting equipment
- PLM integration dolly
- PLM test dolly

Facility instrumentation:
- Astrium OTN building 5.0; clean cabin class 100 Clean room class 100 000
- Facility crane, standard hoisting slings

Personnel:
- Crane operator
- AIT engineer
- AIT technician (vacuum serviceable)
- QA

Safety Precautions:

Standard safety precautions for crane operations are applicable

Special Notes:
n. a.

Activity Number: E.200.010 **Duration:** 12 days

Activity Name: EGSE and CCS Light Set up **Model:** EQM

Objective: Installation and verification of CCS Light set up, cryo SCOE, PLM EGSE and instrument EGSE (including cable connections)

Requirements to be verified:
According EGSE general requirement specification and EGSE I/F requirement specification

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000
- ESD: personal ESD to avoided

Configuration:

- All EGSE already acceptance tested

Activity Breakdown:
- Incoming inspection EGSE
- check EGSE functionality
  - Configuration control
  - Logging and archiving
  - Self tests
- Data base definition and management (import/export)
- Test Software preparation and debugging
- Synoptic picture preparation and display
- Connect Cryo SCOE and PLM EGSE and Instrument EGSE to CCS and check I/F
- Connect Cryo SCOE with CVSE remote control unit
-

Applicable Documents:

- CCS System User Manual
- CCS operation and maintance manual
- PLM SCOE System users manual
- CDMU FEE System Users Manual
- Cryo. SCOE Operation and Maintenance Manual
- Instrument EGSE User Manual

GSE required:

- CCS
- PLM EGSE (PLM SCOE and CDMU FEE)
- Cryo SCOE
- Instrument EGSE
- Electrical check out equipment (IDAS) (for Signal measurement)
- Interconnection Cables

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000
- Check out area

Personnel:
- EGSE operators
- electrical engineer
- QA

Safety Precautions:

Standard safety precautions are applicable

Special Notes:
EMC precautions are applicable

Activity Number:	E.200.020	**Duration:**	22 days
Activity Name:	Integration of WU's to SVM panels	**Model:**	EQM

Objective: Mounting of WU's on SVM panels and preparation of WU's for functional tests

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000
- ESD: personal ESD to avoided

Configuration:
- SVM panels placed in clean room cl. 100 000
- Incoming inspection of WU's performed, WU's released for integration

Activity Breakdown:
- Preparation of WU's I/F fixation areas on SVM panels
- Integration of harness support brackets on SVM panels
- Integration of WU's on SVM panels
- Check grounding of WU's
- Connection of interconnection harness to WU's
- Connection of WU's with PLM EGSE
- Connection of WU's with instrument FPU simulators

Applicable Documents:
- SVM panels assembly drawings
- WU's Handling Manual

GSE required:
- SVM simulator panels
- Instruments FPU simulator

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000

Personnel:
- Instrument representatives
- AIT engineer
- AIT technicians
- EGSE operator
- electrical technicians
- QA

Safety Precautions:
- Standard safety precautions are applicable

Special Notes:
- ESD precautions are applicable

Activity Number:	E.200.030	**Duration:**	30 days
Activity Name:	Functional tests of warm units	**Model:**	EQM

Objective: Functional verification of instrument WU's

Requirements to be verified:
According WU's requirement specification

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000
- ESD: personal ESD to avoided

Configuration:

WU's mounted on SVM panels and connected with PLM EGSE and instrument FPU simulators

Activity Breakdown:

- Preparation of WU's functional test
- TRR
- HIFI test sequence debugging
- PACS test sequence debugging
- SPIRE test sequence debugging
- PACS/SPIRE test sequence debuggig (parallel mode)
- PTR

Applicable Documents:
HIFI WU's test procedure
PACS WU's test procedure
SPIRE WU's test procedure
PACS/SPIRE WU's test procedure (parallel mode)

GSE required:
- PLM EGSE
- CCS light
- Instrument EGSE

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000

Personnel:
- Instrument representatives
- AIT engineer
- EGSE operator
- electrical technicians
- QA

Safety Precautions:
Standard safety precautions are applicable

Special Notes:
ESD precautions are applicable

Activity Number:	E.200.040	**Duration:**	12 days
Activity Name:	Complete SVM simulator pre-integration	**Model:**	EQM

Objective: Completion of SVM simulator integration

Requirements to be verified:
n. a.

Environment:
- temperature: (22 ± 3) ºC
- humidity: 45% < RH < 70%
- cleanliness: class 100 000
- ESD: personal ESD to avoided

Configuration:
- SVM simulator structure and pre-integrated SVM panels placed in clean room cl. 100 000
- Functional test pre-integrated WU's successfully performed

Activity Breakdown:
- Preparation of fixation areas on SVM simulator structure
- Integration of harness support brackets on SVM simulator structure
- Integration of SVM panels to SVM simulator structure
- Installation of SVM SIH
- Connection of SVM SIH
- Check of SVM SIH after connection

Applicable Documents:
- SVM simulator assembly drawings
- SVM SIH assembly drawing

GSE required:
- SVM simulator panels
- SVM simulator structure
- Electrical check out equipment (IDAS) tbc (for Signal measurement)

Facility instrumentation:
- Astrium OTN building 5.0; clean room class 100 000

Personnel:
- Instrument representatives
- AIT engineer
- AIT technicians
- electrical technicians
- QA

Safety Precautions:
- Standard safety precautions are applicable

Special Notes:
- ESD precautions are applicable

END OF DOCUMENT

	Name	Dep./Comp.		Name	Dep./Comp.
	Alberti von Mathias Dr.	AOE22	x	Stritter Rene	AED11
	Alo Hakan	OTN/TP 45		Tenhaeff Dieter	AOE22
x	Barlage Bernhard	AED11		Thörmer Klaus-Horst Dr.	OTN/AED65
x	Bayer Thomas	AET52		Wagner Klaus	AOE23
x	Faas Horst	AEA65	x	Wietbrock, Walter	AET12
	Fehringer Alexander	AOE13		Wöhler Hans	AOE22
	Frey Albrecht	AED422			
	Gerner Willi	AED11			
	Grasl Andreas	OTN/AET52			
	Grasshoff Brigitte	AET12	x	Alcatel	ASP
	Hauser Armin	AOE23	x	ESA/ESTEC	ESA
	Hinger Jürgen	AOE23			
x	Hohn Rüdiger	AET52		**Instruments:**	
	Huber Johann	AOA4		MPE (PACS)	MPE
	Hund Walter	ASE4A		RAL (SPIRE)	RAL
x	Idler Siegmund	AED432		SRON (HIFI)	SRON
x	Ivády von András	FAE22			
	Jahn Gerd Dr.	AOE23		**Subcontractors:**	
	Kalde Clemens	APE3		Air Liquide, Space Department	AIR
	Kameter Rudolf	OTN/AET52		Air Liquide, Space Department	AIRS
	Kettner Bernhard	AOE22		Air Liquide, Orbital System	AIRT
	Knoblauch August	AET32		Alcatel Bell Space	ABSP
x	Koelle Markus	AET22		Astrium Sub-Subsyst. & Equipment	ASSE
x	Kroeker Jürgen	AED65		Austrian Aerospace	AAE
	Kunz Oliver Dr.	AOE23		Austrian Aerospace	AAEM
x	Lamprecht Ernst	OTN/ASI21		APCO Technologies S. A.	APCO
	Lang Jürgen	ASE4A		Bieri Engineering B. V.	BIER
	Langfermann Michael	AET52		BOC Edwards	BOCE
x	Mack Paul	OTN/AET52		Dutch Space Solar Arrays	DSSA
	Muhl Eckhard	OTN/AET52		EADS CASA Espacio	CASA
	Pastorino Michel	ASPI Resid.		EADS CASA Espacio	ECAS
	Peitzker Helmut	AED65		EADS Space Transportation	ASIP
	Peltz Heinz-Willi	AET42		Eurocopter	ECD
	Pietroboni Karin	AED65		HTS AG Zürich	HTSZ
	Platzer Wilhelm	AED22		Linde	LIND
	Puttlitz Joachim	OTN/AET52		Patria New Technologies Oy	PANT
x	Rebholz Reinhold	AET52		Phoenix, Volkmarsen	PHOE
	Reuß Friedhelm	AED62		Prototech AS	PROT
x	Rühe Wolfgang	AED65		QMC Instruments Ltd.	QMC
x	Runge Axel	OTN/AET52		Rembe, Brilon	REMB
	Sachsse Bernt	AED21		Rosemount Aerospace GmbH	ROSE
x	Schink Dietmar	AED422		RYMSA, Radiación y Microondas S.A.	RYM
x	Schlosser Christian	OTN/AET52		SENER Ingenieria SA	SEN
	Schmidt Rudolf	FAE22		Stöhr, Königsbrunn	STOE
	Schweickert Gunn	AOE22		Terma A/S, Birkerod	TER
	Stauss Oliver	AOE13			
	Steininger Eric	AED422			