SUNRISE III

Test Procedure

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ACRONYMS

AC	Alignment Cube
ANG	Angle
BB	Bread Board
CCW	Counter clockwise
CSBF	Columbia Scientific Balloon Facility
CTRL	Controller
CW	Clock wise
CWS	Correlation Tracker & Wavefront Sensor
EM	Engineering Model
EUT	Equipment Under Test
FM	Flight Model
fps	Frames per Second
GN2	Nitrogen Gas
GUI	Graphical User Interface
HK	House Keeping
hPa	hectopascals
HSCL	High Speed Channel Link
ICD	Interface Control Document
ICS	Instrument Control System
ISLiD	Image Stabilisation and Light Distribution
KIS	Kiepenheuer-Institut Freiburg, Germany
LN2	Liquid Nitrogen
LVDS	Low-voltage Differential Signalling
MPS	Max Planck Institute for Solar System Research
NAOJ	National Astronomical Observatory of Japan
NASA	National Aeronautics and Space Administration
NCR	Non-Conformance report
NRB	Non-Conformance Review Board
OCP	Over Current Protection
OVP	Over Voltage Protection
PBC	Polarizing Beamsplitter Cube
PMU	Polarization Modulation Unit
PMU-DRV	PMU Driver (SCIP, SUSI)
PMU-ROT	PMU Rotator (SCIP, SUSI)
QS	Quad Steps on Stepper motor
RPM	Revolutions per minute
RT+PR	room temperature and pressure
SCIP	Sunrise Chromospheric Infrared spectra-Polarimeter
SFW	SUSI Filter Wheel Mechanism
SGM	SUSI Grating Mechanism
SSM	SUSI Scanning Mechanism
SUSI	Sunrise Ultraviolet Spectropolarimeter and Imager
TBC	To Be Confirmed
TBD	To Be Discussed
TBW	To Be Written
TuMag	Tunable Magnetograph
TV	Thermal Vacuum
URP	Unit Reference Point

1 GENERAL ASPECTS

1.1 SCOPE

This document is a test procedure for the SUNRISE III PFI vacuum test in Bigmac thermal vacuum chamber at MPS. This test is a vacuum and optical test without any thermal cycling or any sort of thermal control at any interfaces of PFI or the TV chamber.

1.2 INTRODUCTION

SUNRISE is a balloon-born stratospheric solar observatory based on a 1 meter aperture telescope. The telescope feeds the science instrumentation located piggy-back on the telescope central frame. This PFI consists of modules (mainly science instruments) and a supporting structure. The optical modules are self-contained, pre-aligned items that shall be individually integrated, mounted and aligned with respect to each other.

1.3 APPLICABLE DOCUMENTS

Table 1.1: Applicable documents

No.	Document Title	Document Number	Iss.	Rev.	Date
AD01.	Global list of Acronyms and Synonyms	SR3-MPS-LI-GEN-002			See latest Iss/Rev
AD02.	Sunrise-3 Science, Technical and Operational Requirements	SR3-MPS-SP-GEN-003	D	b	20-March-2019
AD03.	Harness & Connector Overview	SR3-MPS-DR-SR800-001	1	b	18-Mar-2020
AD04.	SUSI Requirements	SR3-MPS-SP-US000-001	1	-	05-Feb-2020
AD05.	Report: Pre-test of 1 mbar TV test at SGI-2	SR3-MPS-RP-AV700-006	D	-	11-Dec-2019
AD06.	SUSI test procedure for PFI Vacuum test	SR3-MPS-PR-AV700-011	D	-	14-Feb-2022
AD07.	SCIP test procedure for PFI Vacuum test	SCIP_PFI_VACTEST	1	0	22-Feb-2022
AD08.	TuMag Polarimetric E2E test procedure	SR3-IMAXP-PR-av600-003	1	A	
AD09.	TuMag Spectral E2E Test Procedure	SR3-IMAXP-PR-AV600-004	1	A	
AD10.	TuMag E-Unit Functional Test Procedure with Optical Unit	SR3-IMAXP-PR-AV610-004	1	A	

1.4 REFERENCE DOCUMENTS

Table 1.2: Reference documents

No.	Document Title	Document Number	Iss.	Rev.	Date
RD01.	Space engineering — Testing	ECSS-E-ST-10-03	C		01-Jun-2012
RD02.	SCIP Harness Block Diagram	SR3-SCIP-DE-IS700-002	1	B	13-May-2021
RD03.	TuMag Harness Block Diagram	SR3-IMAXP-DR-IX800-001	2	B	13-May-2021
RD04.	SUSI Harness and connector overview	SR3-MPS-DR-US750-001	1	B	20-Jun-2019
RD05.					

2 EQUIPMENT UNDER TEST

Table 2.1: Configuration of PFI for vacuum test

No.	Item	Units	Remarks
01.	ISLiD	OPT unit	
02.		ELE unit	
03.	CWS	OPT unit	
04.	SUSI	OPT Unit	
05.		ELE unit.	
06.	SCIP	OPT unit	
07.	TuMag	OPT unit	
08.		ELE unit	

3 REQUIREMENTS MAPPING

Req No.	Description	Specification	Source/ Remarks
3.1 GENERAL FOR ALL UNITS.			
TV-101.	Pressure	1 mbar - 10 mbar	
TV-102.	All units will be powered with input voltage of	25.6 V	
TV-103.	All units shall be switched ON and operated in the temperature range of	Room temperature 18deg C - 22 deg C	Without any thermal control
TV-104.	~~All units shall be switched ON with low voltage input~~	~~Switch on with 21 V~~	NA for this test, as it was confirmed in previous tests
TV-105.	Units shall be powered via	PPD on respective E-racks	
TV-106.	All units shall be commanded from	ICS FM-2	
3.2 ISLID			
TV-201.	Successful operation in vacuum conditions (light distribution to instruments)		See ISLID design specifications.
TV-202.			
3.3 CWS			
TV-301.	Successful operations in vacuum conditions (image stabilisation)		
TV-302.			
3.4 SUSI			
TV-401.	See SUSI Test procedure		AD06
TV-402.			
3.5 SCIP			
TV-501.	See SCIP Test procedure		
TV-502.			
3.6 TUMAG			
TV-601.	See TuMag Test procedure		
TV-602.			

4 TEST TOLERANCES

Table 4.1: Test tolerances as per RD01

No.	Test parameter	Range	Tolerances
01.	Temperature	T above 80K (-193 °C)	T_{min} : +0/-4 °C T_{max} : -0/+4 °C
02.	Pressure in vacuum chamber	1.3E-3 mbar to 1.3 mbar	± 30 %
03.	Pressure in vacuum chamber	< 1.3E-3 mbar	± 80 %
04.	Test duration		-0 / +10%

5 TEST ACCURACIES

Table 5.1 : Test accuracies as per RD01

No.	Test parameter	Range	Accuracies
01.	Temperature	T above 80K (-193 °C)	± 2 °C
02.	Pressure in vacuum chamber	1.3E-3 mbar to 1.3 mbar	± 30 %
03.	Pressure in vacuum chamber	< 1.3E-3 mbar	± 80 %

6 TEST CONDITIONS

6.1 CLEANLINESS DURING THE TV TEST.

The Bigmac TV chamber is in ISO-8 Clean room and the test setup is prepared in the same room.
MGSE hardware and EGSE harness were cleaned and bake-out was performed before installing in the TV chamber.

The electronics boards are coated with conformal coating.

Gloves and face mask will be used while handling optical units.

6.2 AMBIENT TEST CONDITIONS

Table 6.1: Ambient test conditions

No.	Item	Description	Remarks
01.	Temperature	22 °C ± 3 °C	
02.	Relative Humidity	55 % ± 10 %	
03.	Pressure	Ambient	
04.	Cleanliness	ISO 8	

6.3 VACUUM TEST CONDITIONS

Table 6.2: Vacuum test conditions

No.	Item	Description	Remarks
01.	Hot Non-Op temperature	NA	
02.	Hot Op temperature	NA	
03.	Cold Op temperature	NA	
04.	Cold Non-Op temperature	NA	
05.	Rate of change of temperature	NA	
06.	Stabilisation criteria	NA	
07.	Dwell time	NA	
08.	Chamber Pressure	1-10 mbar	

6.4 LOW PRESSURE TEST CONDITIONS

The Bigmac chamber will be in low pressure conditions (1 – 10 mbar vacuum) during the entire vacuum test. Refer AD05 for detailed procedure of operation of chamber to prepare it for low vacuum conditions. A vacuum controller from Vacuubrand, CVC 3000, together with the pre-pump, valve and continuous flow of gas nitrogen will be used to maintain the required 1-10 mbar low vacuum inside the Bigmac chamber. This controller has a minimum hysteresis of 1 mbar and can be increased if necessary.

7 PASS/FAIL CRITERIA

See individual instrument test procedure

8 TEST FACILITY DESCRIPTION

8.1 BIGMAC TV CHAMBER AT MPS

The PFI vacuum test will take place in the Bigmac TV chamber located at MPS, Göttingen. The main characteristics of the Bigmac chamber can be found in Figure 8.1 and Figure 8.2. The Bigmac base plate is divided into four sections, having 1250 mm of length each. The thermal shroud (SHR) is divided in six sections; four of them correspond to the four sections in which the BP is divided. The other two SHR sections correspond to the Bigmac doors, one each at cleanroom and grey room side. Control of the SHR sections can be activated individually, but the temperature set point is unique. The same applies to the BP. Figure 8.3 shows the different SHR and BP sections.

Table 8.1: Bigmac main characteristics and performances

Property	Value
Thermal control	LN2 / heaters
Temperature range - SHR	-170 / +100 °C
Temperature range - BP	-170 / +100 °C
Vacuum level	10^{-6} mbar
SHR dimensions	Diameter: 2 m/Length: 5 m
BP dimensions	Width: 1.4 m/ Length: 5 m
Pumps	Pre-pumps, Turbo pump and Cryo pump.
Vacuum controller	CVC 3000

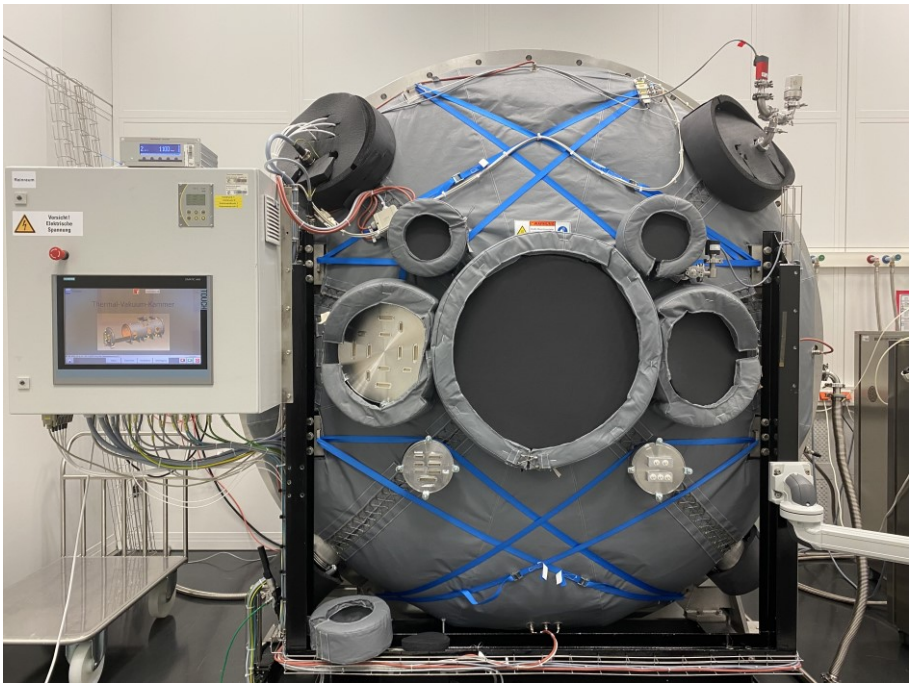


Figure 8.1: Bigmac chamber, front view, clean room side

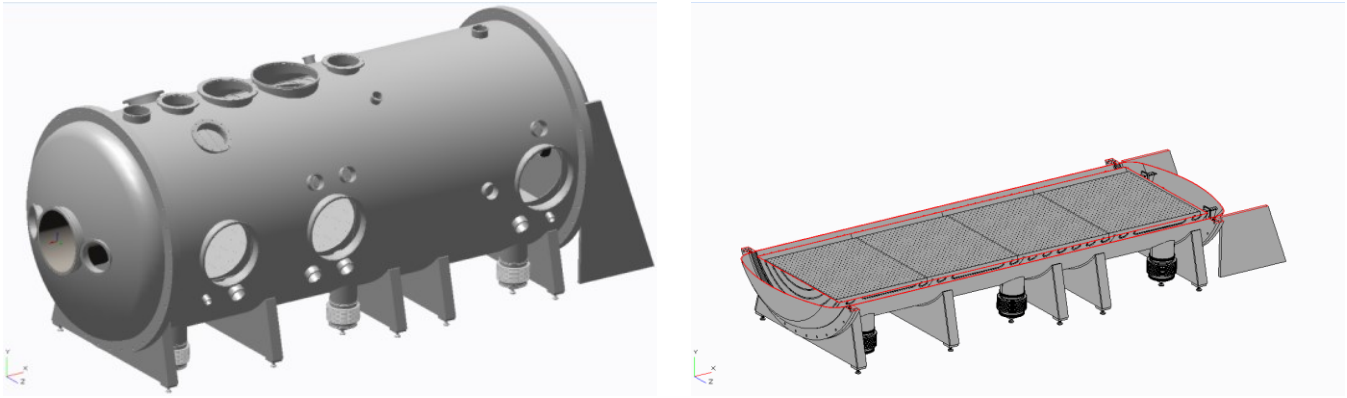


Figure 8.2: Bigmac chamber – CAD views.

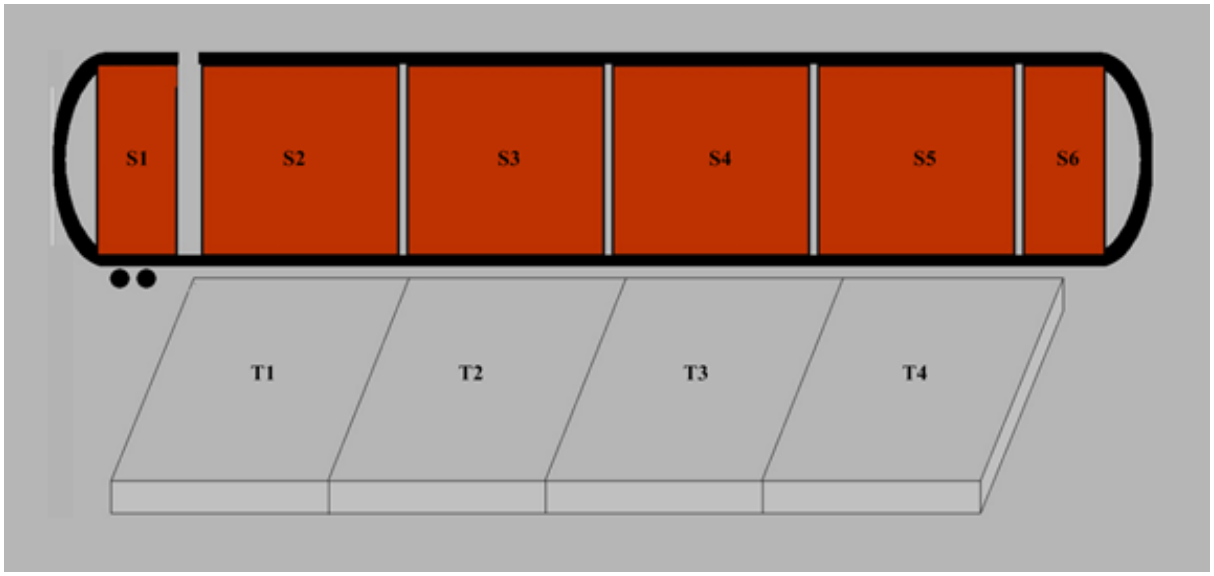


Figure 8.3: Bigmac chamber – diagram with SHR and BP sections.

9 TEST SETUP

9.1 TEST SEQUENCE

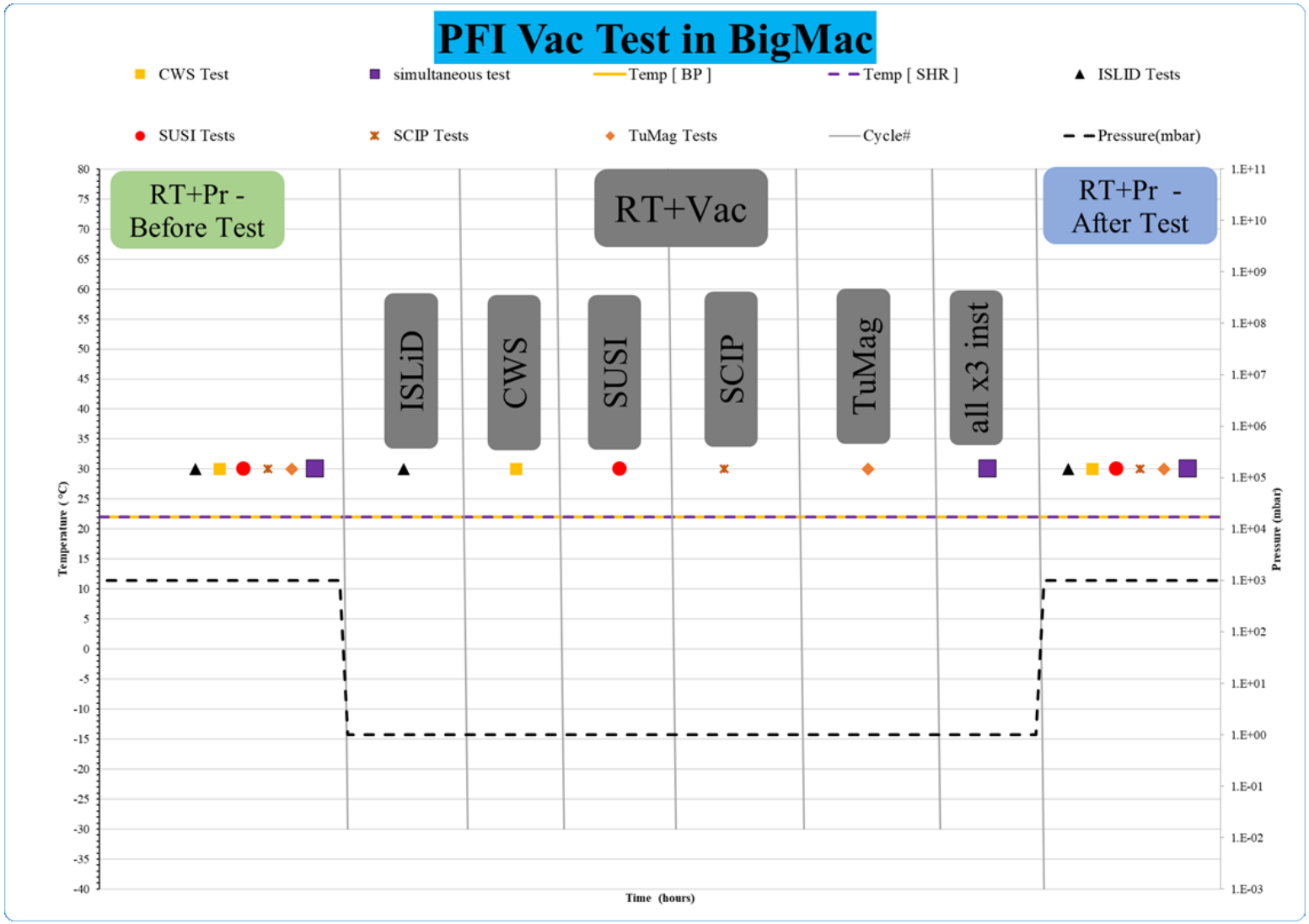


Figure 9.1: PFI Vacuum test sequence

9.2 ELECTRICAL SCHEMATICS

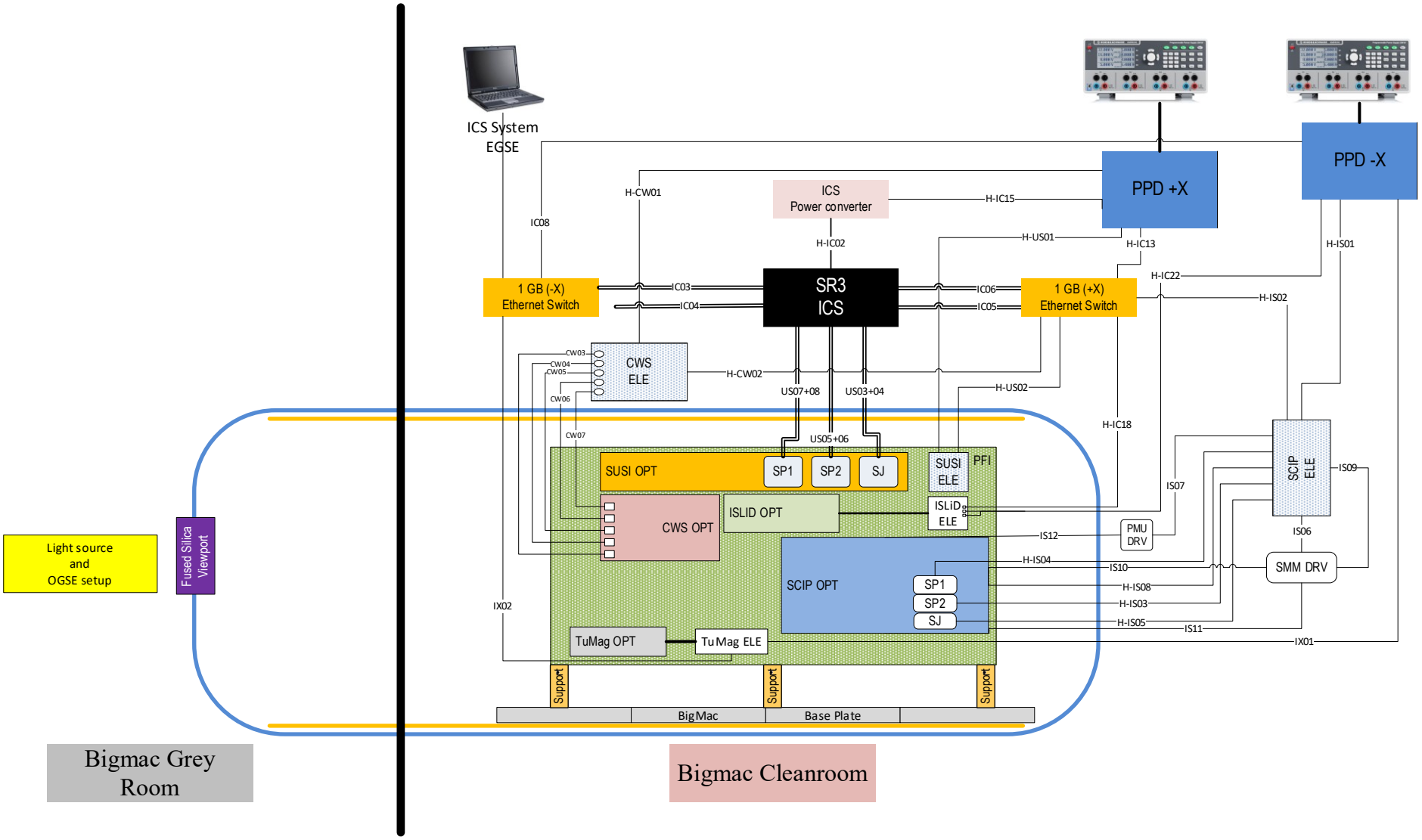


Figure 9.2: Electrical schematics for PFI Vacuum Test – updated.

9.3 LIST OF HARNESSES

Table 9.1: List of harnesses for PFI Vacuum Test

	Name	Instrument	Connector PFI	Connector Feed Through	Connector Number	Connector E-Unit	Comment	Test Harness Specification
1	H-US03	SUSI	Duplex LC connector	ST	3/1	Duplex LC connector	available	
	H-US04	SUSI		ST	3/2			
2	H-US05	SUSI	Duplex LC connector	ST	3/3	Duplex LC connector	available	
	H-US06	SUSI		ST	3/4			
3	H-US07	SUSI	Duplex LC connector	ST	3/5	Duplex LC connector	available	
	H-US08	SUSI		ST	3/6			
4	H-US01	SUSI	D-SUB 9 s	D-SUB 15 s	1/12	D-SUB 15 p		H-US01 T
5	U-US02	SUSI	RJ45	D-SUB 25 s	1/8	RJ45		H-US02 T
6	H-IS03	SCIP	BNC 75Ω	BNC 75Ω	4/1	BNC 75Ω		
7	H-IS04	SCIP	BNC 75Ω	BNC 75Ω	4/2	BNC 75Ω		
8	H-IS05	SCIP	BNC 75Ω	BNC 75Ω	4/3	BNC 75Ω		
9	H-IS08	SCIP	D-SUB50 s	D-SUB 50 s	1/1	D-SUB 50 p		H-IS 08 T
10	H-IS10	SCIP	D-SUB 15 p	D-SUB 15 s	1/9	D-SUB 15 p		H-IS 10 T
11	H-IS11	SCIP	D-SUB 15 p	D-SUB 15 s	1/10	D-SUB 15 s		H-IS 11 T
12	H-IS12	SCIP	D-SUB 25 s	D-SUB 25 s	1/5	D-SUB 25 p		H-IS 12 T
13	H-CW03	CWS	D-SUB 9P	D-SUB 15s	2/5	D-SUB 9S		H-CW 03 T
14	H-CW04	CWS	D-SUB 15P	D-SUB 15s	1/11	D-SUB 15S		H-CW 04 T
15	H-CW05	CWS	MD 26P<>D-Sub25P	D-SUB 25s	1/6	D-SUB 25 P	Together with CW05 FM harness	H-CW 05 T
16	H-CW06	CWS	D-SUB 9S	D-SUB 15s	2/6	D-SUB 9 P		H-CW 06 T
17	H-CW07	CWS	D-SUB 9s	D-SUB 15s	2/7	D-SUB 9 P		H-CW 07 T
18	H-IC18	ISLiD	RJ45	D-SUB 25s	2/2	RJ45		H-IC 18 T
19	H-IC22	ISLiD	D-SUB 9S D-SUB 9S	D-SUB 25s	1/7	D-SUB 9 P		H-IC 22 T
20	IX01	TuMag	D-Sub 15 s	D-Sub 50 S		D-SUB 25P D-Sub-15P		H-IX01-T
21	IX02	TuMag	D-Sub 9P	D-Sub 25 s		RJ-45		H-IX02-T

9.4 TEMPERATURE SENSORS

The chamber is equipped with x60 PT100 temperature sensor read via a Texas instruments' data acquisition system with LabVIEW as an Interface. However, as we are not testing with thermal control, we plan to use the internal temperature sensors attached to the units and instruments for monitoring the temperatures during the test.

10 GSE AND TEST TOOLS

10.1 MGSE

10.1.1 ADAPTERS LEGS FOR PFI.

A set of 7 adapter legs are prepared to place the PFI on an optical axis of the Bigmac view ports and to firmly place them on the bigmac base plate.

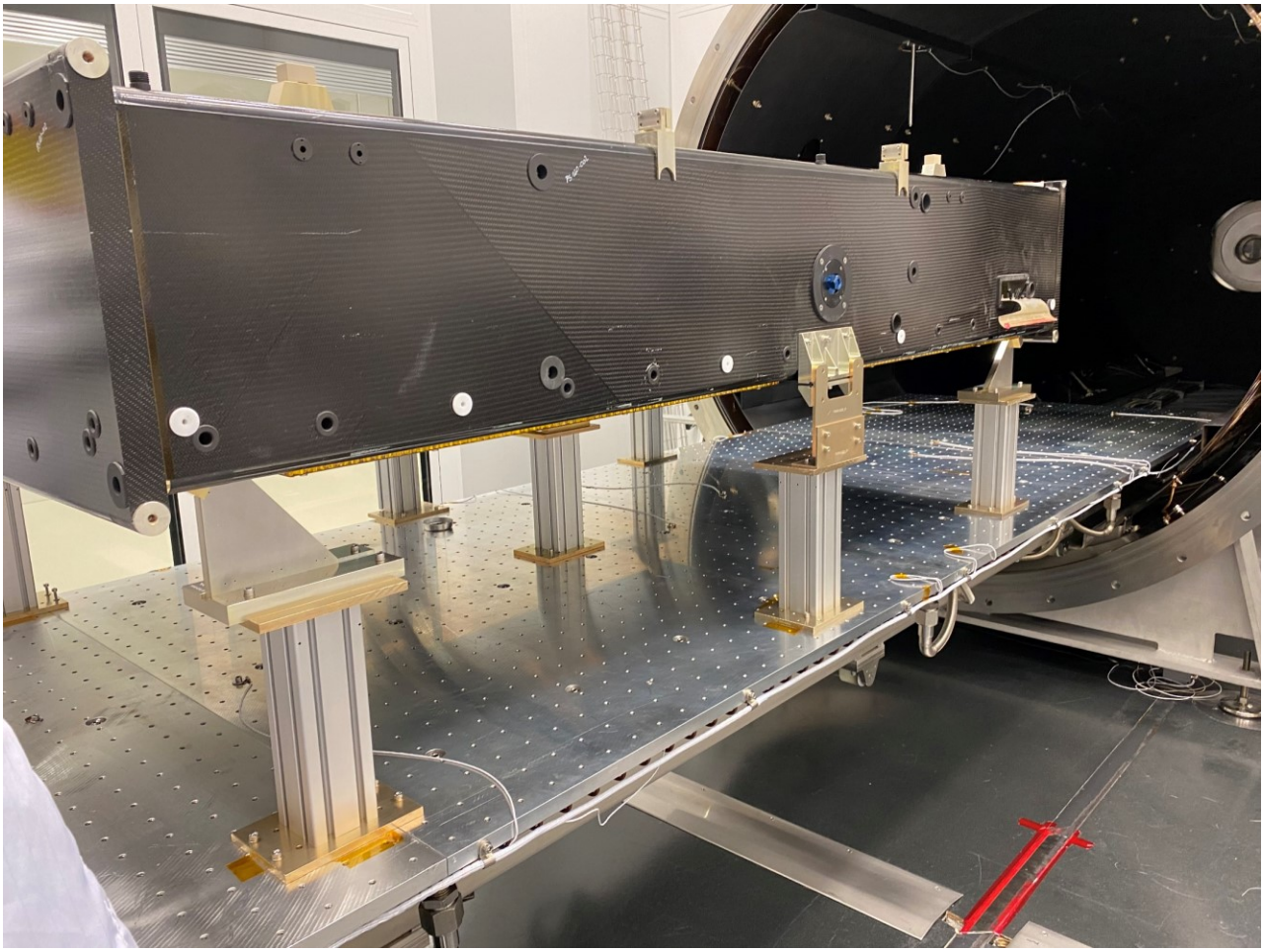


Figure 10.1: Adapters to raise the PFI to be in line with Bigmac optical axis.

10.1.2 SEQUENCE OF MOUNTING THE PFI FROM DOLLY TO ADAPTERS

1. Verify that the adapter legs (see §10.1.1) are mounted on the Bigmac base plate (same configuration as in the fit check).
2. Verify that the Bigmac door is completely closed before moving the PFI into test room.
3. The PFI is mounted on a dolly in ISO8 cleanroom hall using its hoisting device.
4. Transfer the hoisting device and slings to Bigmac test room.
5. Prepare the crane and hoisting device in Bigmac test room.
6. PFI is then taken into the Bigmac test room via the corridor (optical aperture facing front).
7. Move past the bigmac door opening stay out area and park in front of SUMER chamber with its aperture facing Bigmac chamber.
8. Attach the hoisting device to lift the PFI.
9. Lift the PFI (aperture facing Bigmac chamber) and move over the assembled adapter legs on Bigmac base plate.
10. Align the PFI's cross bar to the adapter leg's interface (center).
11. Now slowly rotate the PFI to have the aperture facing the optical view port at Bigmac grey room side.
12. Slowly lower the PFI onto the adapter leg such that the PFI's cross bar aligns with the centre adapter plate.
13. Slowly lower the PFI to rest completely on the x4 interfaces of the adapter legs.
14. Perform optical alignment check with respect to the view port at the grey room door. (Viewports needs to be dismantled).
15. Once aligned, firmly fix the PFI using the x2 side plates.
16. Remove the hoisting device from the PFI and move the crane to its parking location.
17. Firmly fix the PFI using x4 screw at x4 interfaces.

10.2 EGSE

10.2.1 .ELECTRICAL FLANGES

10.2.1.1 OPTICAL FIBRE FEEDTHROUGH

To connect x5 pairs of HSCL cables with the ICS, 2 set of flanges as listed below are used.

160 ISO_K PAVE	
Pair #1	SUSI SP1 [US07+08]
Pair #2	SUSI SP2 [US05+06]
Pair #3	SUSI SJ [US03+04]

Figure 10.2: HSCL PAVE ST connectors

10.2.1.2 COAX-PRESS BNC CONNECTORS

Figure 10.3: Flange DN160 with Coax-Press connectors

Figure 10.4: CoaxPress BNC 75Ω connectors

10.2.1.3 SUB-D FLANGES.

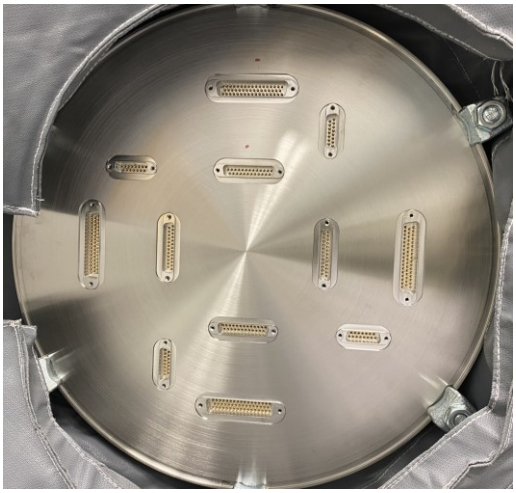


Figure 10.5 A DN320 Electrical flange with Sub-D connectors

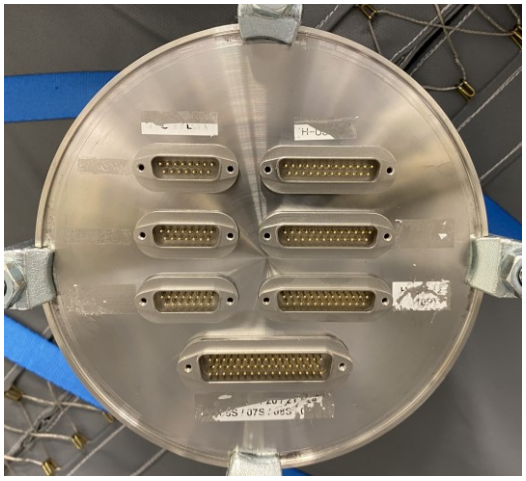
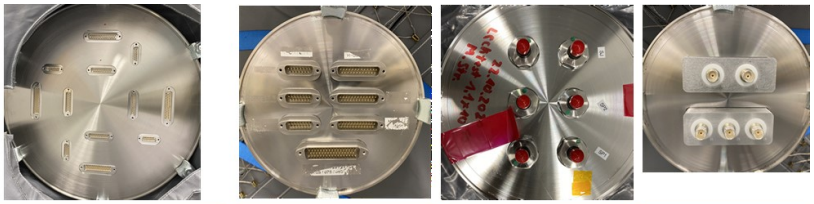


Figure 10.6: A DN160 Electrical flange with Sub-D connectors

10.2.2 ORGANISATION OF FLANGES IN BIGMAC TV CHAMBER



320 ISO_K [SubD connectors]	
50	
50	IX 01
50	
50	
25	IX 02
25	IS 12
25	
25	CW05
15	CW 04
15	CW 06
15	CW 07
15	CW 03

160 ISO_K [SubD connectors]	
50	IS 08
25	IC 22
25	IC 18
25	SUSI Data [US02]
15	SUSI power [US01]
15	IS 10
15	IS 11

Bottom left

160 ISO_K PAVE		
Pair #1	SUSI SP1	[US07+08]
Pair #2	SUSI SP2	[US05+06]
Pair #3	SUSI SJ	[US03+04]

Top left

160 ISO_K BNC75	
BNC 75	IS03
BNC 75	IS04
BNC 75	IS05
BNC 75	Free to use
BNC 75	Free to use

Bottom right

10.3 OGSE

10.3.1 LIGHT SOURCE

An artificial light source with all the required setup to feed the light to the Bigmac will be setup in the grey room side of the Bigmac. LEDs with various wave lengths in the UV to near infrared range will be used.

10.3.2 CELEOSTAT

The spectral calibration is done illuminating the PFI inside Bigmac with sunlight, by means of the ceolostat installed at the MPS. For the spectral calibration, it is necessary to have a sunny day. Hence PFI tests with sunlight is not guaranteed and performed only on a best effort basis when sunlight is available.

10.3.3 VIEW PORTS

A DN200 CF Fused silica view port is used to feed light inside the TV chamber for PFI optical tests.

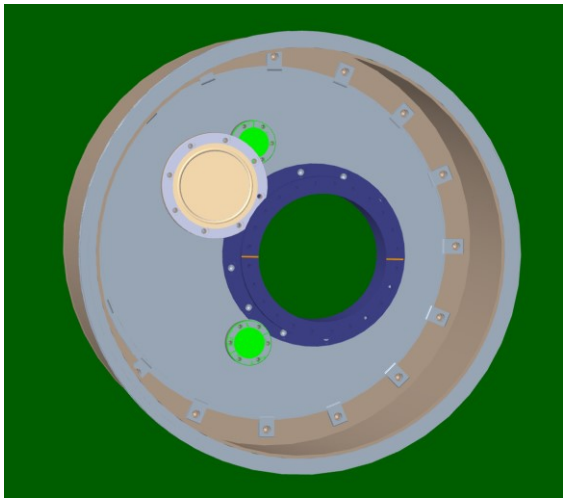


Figure 10.7: DN200 Fused Silica on DN300 KF flange.

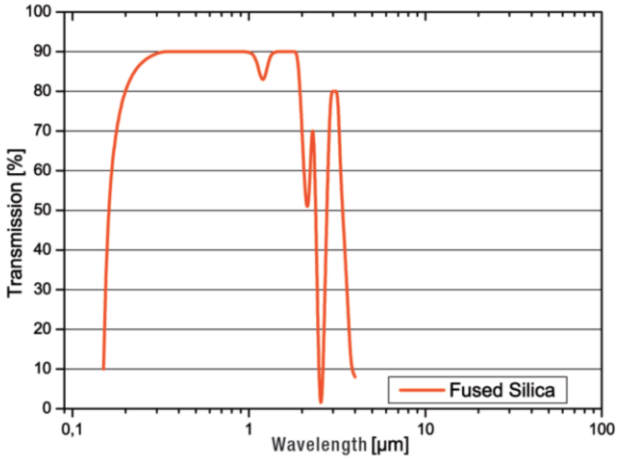


Figure 10.8: Optical Glass, Fused Silica (Synthetic Amorphous Quartz)

11 TEST INSTRUMENTATION

Table 11.1: Test instrumentation

No.	Instrument	Model No	Serial No	Accuracy	Calibrated on
01.	Theodolite	Leica TM5100A		Accuracy Hz (for infinity): 0.2 mgon Accuracy V (for infinity): 0.2 mgon	
02.	Data acq system	Agilent 34970A			
03.	Multimeter	Fluke 89			
04.	Data logger	GL980		8 ch voltage measurement	
05.	Power Supply	HMP4040			
06.	Oscilloscope	LeCroy WaveRunner 610Zi			
07.	Current Probe(s)	LeCroy 2x CP030			
08.	Voltage Probe(s)	LeCroy 4x PP008			
09.	Differential Probe(s)	LeCroy ZD1000 (1GHz)			
10.	Cannon camera	80D			
11.	UV light source	Ocean Optics			
12.	UV LED				

12 TEST DESCRIPTION

12.1 ISLID

ISLID will be switched ON and operated all the time facilitating the operation and performance verification of the rest of the three instruments.

12.2 CWS

CWS will be switched ON and operated all the time facilitating the operation and performance verification of the rest of the three instruments.

12.3 SUSI

SUSI will be operated as per the sequence in its test procedure. Refer dedicated operation and functional test procedure of SUSI (AD06) when necessary.

12.4 SCIP

SCIP will be operated as per the sequence in the test procedure. Refer dedicated operation and functional test procedure of SCIP from NAOJ when necessary.

12.5 TUMAG

TuMag will be operated as per the sequence in the test procedure. Refer dedicated operation and functional test procedure of TuMag from IAA/INTA when necessary.

13 TEST AND OPERATIONS CONSTRAINTS

13.1 GENERAL PRECAUTIONS AND SPECIAL SAFETY NEEDS

01. The test equipment and associated GSEs shall be handled with care and all safety precautions shall be observed.
02. Personnel not designated by the Test Conductor as having a necessary function for performance of the test shall not be allowed in the area.
03. Handling, mounting and testing shall be done only by qualified personnel. Precaution against unauthorized operation of equipment has to be foreseen.
04. Only the responsible test engineer, the test conductor or the support engineer will be allowed to abort a test by means of an emergency push-button.
05. The general safety requirements of the MPS laboratory shall be applied during all operations.
06. The EUT shall be grounded before performing any functional tests.
07. Team members shall wear UV protective glasses during the operation of UV light source. (Only in the direct vicinity of the illumination setup in the grey room. Not necessary in TV chamber room!)

13.2 OPERATIONAL CONSTRAINS

01. Temperature sensors shall not be placed on any moving parts of the mechanism.
02. Temperature sensors shall not be placed at the stay out volume of the mechanism.
03. Temperature sensors shall not be placed on painted surfaces.
04. Any deviation from the TV test procedure and/or functional test procedure shall be noted in Table 16.1: Procedure deviation list.

13.3 DAY TO DAY TV CHAMBER OPERATION

As the EUT are FM hardware, keeping safety and security in mind, following operation pre-cautions shall be practised.

01. As this test is only a vacuum test without the thermal control, heaters and LN2 will not be used during any part of the test.
02. However, as the pumps are switched off to minimize the vibrations for optical tests, we will monitor the pressure rise during the operation of the instruments.
03. The tests will be conducted (instruments will be operated) in x2 shifts per day basis. A dedicated team will continuously monitor the TV chamber while operations of the instruments are underway.
04. Overnight, the instruments will be off and chamber will be un-attended.

14 PARTICIPANTS

Table 14.1: Test Participants

No.	Name	Dept / Institute	Responsibility	Email / Telephone	Remarks
01.	A. Lagg	MPS	SR3 Project Manager		
02.	A. Gandorfer	MPS	Project scientist		Test conductor ISLID
03.	W. Deutsch	MPS	Test Lead/ SR3 System Engineer	357	
04.	S. Ramanath	MPS	Test conductor AIV Engineer	494	
05.	G. Fernandez Rico	MPS	Thermal Engineer		
06.	T. Berkefeld	KIS	CWS		Test Conductor CWS
07.	A. Feller	MPS	SUSI PM		Test Conductor – SUSI
08.	Y. Katsukawa	NAOJ	SCIP PM		Test Conductor – SCIP
09.	A. Álvarez Herrero	INTA	TuMAG OPT PM		Test Conductor – TuMAG
10.	A. Lopez	IAA	TuMAG ELE unit PM		
11.	D. Orozco	IAA	TuMag		
12.	T. Riethmueller	MPS	Software Engineer		
13.	S. Goodyear	MPS	Software Engineer/ Test conductor		
14.	K. Heerlein	MPS	El. Engineer (SUSI cameras)		
15.	R. Enge	MPS	Ele Engineer		
16.	M. Bayon Laguna	MPS	ICS / Thermal Engineer		
17.	SCIP				Remote support
18.	TuMAG				Remote support
19.	CWS				Remote support
20.					

15 STEP BY STEP PROCEDURE

15.1 GENERAL TEST SETUP PREPARATION

15.1.1 EUT AND GSES.

Table 15.1: Step by step procedure

Step no.	Action	Check/comments	Date /time	Operator
General test setup preparation				
1.01	Collect the following EUT a. Integrated PFI b. TuMag ELE unit			
1.02	Collect all MGSE a. PFI Hoisting device.+slings b. PFI support structure c.	See § 10.1		
1.03	Collect all EGSE a. ICS (ICS-2) b. ICS Power converter unit + Cho therm. c. Ethernet switch (+x and -x). d. Connector panel. e. PPD f. Instrument E-units on E-Racks	See § 10.2		
1.04	Collect all OGSE			

15.1.2 SETUP INSIDE THE TV CHAMBER

1.05	Verify the mounting of the PFI attachment holders on the Bigmac Base plate			
1.06	Carefully mount the PFI on the holders using a crane	See § 10.1.2		
1.07	Mount the TuMag ELE unit.			
1.08	Verify the pinouts of all power harness.			
1.09	Connect test harnesses	See		
1.10	Connect grounding cables.			
1.11	Mount external temperature sensors if necessary	NA		
1.12	Verify the optical alignment of PFI with the light source.	From grey room.		

15.1.3 SETUP OUTSIDE THE TV CHAMBER

1.13	Place E rack (both +ve and -ve) at a closer distance to the Bigmac			
1.14	Connect power supplies to PPD at each E rack.			
1.15	Set the OCP for the power supply CH1 and CH2 to 5 A [tbc]			
1.16	Set the input voltage of power supply CH1 and CH2 to 25.6 V			
1.17	Remove all the tools and foreign items			
1.18	Verify the position of all temperature sensors			
1.19	Setup the OGSE for artificial light source in Bigmac grey room			

15.2 CASE: RT+PR – BEFORE TEST

15.2.1 OVER ALL SYSTEM CHECKOUT

Step no.	Action	Check/comments	Date /time	Ope rato
	System checkout in ambient conditions (RT+Pr – Before Test)			
2.01	Start the Bigmac data acquisition system.			
2.02	Set the data acquisition interval of Bigmac to 60 Sec			
2.03	Record temperatures			
2.04	Switch on the artificial light source [grey room of the bigmac]			
2.05	Switch on Power supply (CH1 +CH2) to Power ON E-Racks. All units should be ON now. (Will continue to be ON for the whole test, except for a reset test)	25.6V Input Current: Total Power:		
2.06	Confirm ICS FM-2 booting			
2.07	Confirm successful switch ON of PPD (both)			
2.08	Operation and functional check of ISLID			
2.09	Power consumption measurement			

Step no.	Action	Check/comments	Date /time	Operator
	System checkout in ambient conditions (RT+Pr – Before Test)			
2.10	HK data incl temperatures			
2.11	Data pipe line and data rate.			
2.12	Operation and functional check of CWS			
2.13	Power consumption measurement			
2.14	HK data incl temperatures			
2.15	Data pipe line and data rate.			
2.16	Operation and functional check of SUSI			
2.17	Power consumption measurement	Without heaters test.		
2.18	HK data incl temperatures			
2.19	Data pipe line and data rate.			
2.20	Switch OFF SUSI			
2.21	Operation and functional check of SCIP			
2.22	Power consumption measurement			
2.23	HK data incl temperatures			
2.24	Data pipe line and data rate.			
2.25	Switch OFF SCIP			
2.26	Operation and functional check of TuMag	With High Voltage		
2.27	Power consumption measurement			
2.28	HK data incl temperatures			
2.29	Data pipe line and data rate.			
2.30	Switch OFF TuMag			
2.31	Record ICS pressure and RH values.	PR: RH:		

Step no.	Action	Check/comments	Date /time	Operato
	System checkout in ambient conditions (RT+Pr – Before Test)			
2.32	Simultaneous operation of all 3 instruments SUSI + SCIP + TuMag			
2.33	Switch on SUSI			
2.34	Switch on SCIP			
2.35	Switch on TuMag			
2.36	Tests with all x3 instruments			
2.37	Switch OFF SCIP			
2.38	Switch OFF TuMag			
2.39	SUSI heaters test.			
2.40	Switch OFF SUSI			
2.41	Switch off CWS and ISLID			
2.42	Switch off the power supply for E-racks.			
2.43				

15.3 CASE: OP-CYCLE-1

15.3.1 PUMPING DOWN

Step no.	Action	Check/comments	Date /time	Ope rator
	Case: OP-cycle-1 Preparations			
3.01	Check and remove any tools and/or any foreign objects inside the TV chamber.			
3.02	Check for temp sensor cables and harness			
3.03	Close the door			
3.04	Remove x2 pins from either sides of cleanroom door to decouple the Bigmac base plate from the TV chamber door.			
3.05	Pump down the chamber to reach low vacuum only	1 mbar – 10mbar See §.AD05		
3.06	Setup CVC 3000 (vacuum controller) to maintain 1 mbar pressure inside Bigmac			
3.07	Switch off turbo pumps and pre-pumps to minimise the vibrations. (Cryo pump is already off)			

15.3.2 OPERATION CASE – ROOM TEMPERATURE + LOW VACUUM

Step no.	Action	Check/comments	Date /time	Op rato
	OPERATION CASE – ROOM TEMPERATURE + LOW VACUUM			
3.08	Start the Bigmac data acquisition system.			
3.09	Set the data acquisition interval of Bigmac to 60 Sec			
3.10	Record temperatures			
3.11	Switch on the artificial light source [grey room of the bigmac]			
3.12	Switch on Power supply (CH1 +CH2) to Power ON E-Racks. All units should be ON now. (Will continue to be ON for the whole test, except for a reset test)	25.6V Input Current: Total Power:		
3.13	Confirm ICS FM-2 booting			
3.14	Confirm successful switch ON of PPD (both)			

Step no.	Action	Check/comments	Date /time	Ope rato
	OPERATION CASE – ROOM TEMPERATURE + LOW VACUUM			
3.15	Operation and functional check of ISLID			
3.16	Power consumption measurement			
3.17	HK data incl temperatures			
3.18	Data pipe line and data rate.			
3.19	Operation and functional check of CWS			
3.20	Power consumption measurement			
3.21	HK data incl temperatures			
3.22	Data pipe line and data rate.			
3.23	Operation and functional check of SUSI			
3.24	Power consumption measurement	Without heaters test.		
3.25	HK data incl temperatures			
3.26	Data pipe line and data rate.			
3.27	Switch OFF SUSI			
3.28	Operation and functional check of SCIP			
3.29	Power consumption measurement			
3.30	HK data incl temperatures			
3.31	Data pipe line and data rate.			
3.32	Switch OFF SCIP			
3.33	Operation and functional check of TuMag	With High Voltage		
3.34	Power consumption measurement			
3.35	HV operation of TuMag			
3.36	HK data incl temperatures			
3.37	Data pipe line and data rate.			

Step no.	Action	Check/comments	Date /time	Ope rato
	OPERATION CASE – ROOM TEMPERATURE + LOW VACUUM			
3.38	Switch OFF TuMag			
3.39	Record ICS pressure and RH values.	PR: RH:		
3.40	Simultaneous operation of all 3 units SUSI + SCIP + TuMag			
3.41	Switch on SUSI			
3.42	Switch on SCIP			
3.43	Switch on TuMag			
3.44	Tests with all x3 instruments			
3.45	ICS RESET Test	TBC		
3.46	SUSI heaters test.			
3.47	Switch OFF SUSI			
3.48	Switch OFF SCIP			
3.49	Switch OFF TuMag			
3.50	Switch off CWS and ISLID			
3.51	Switch off the power supply for E-racks.			

15.3.3 ANALYSIS OF THE DATA BEFORE OPENING THE CHAMBER.

Step no.	Action	Check/comments		Date /time	Ope rato
	Quick analysis of test results				
3.52	Quick data analysis				
3.53	Meetings with individual instrument teams or together.				
3.54	Check the need to conduct additional tests	YES	NO		
3.55	If YES, DONOT open the chamber.				
3.56	Continue with the additional tests as required.				
3.57	If NO, continue with the section §15.4.1 Venting				

15.4 CASE: RT+PR-AFTER TEST.

15.4.1 VENTING

Step no.	Action	Check/comments	Date /time	Ope rato
	RT+Pr (After Test) Preparations			
4.01	Switch off active temperature control of Shroud + Base plate	If used.		
4.02	Vent the chamber [*Waiting time: >60 mins*]			
4.03	Replace x2 pins back on either sides of Bigmac cleanroom door.			
4.04	Open the chamber door			
4.05	Conduct visual inspection of units			
4.06	Check for slipped temperature sensors			

15.4.2 OVER ALL SYSTEM CHECKOUT

Step no.	Action	Check/comments	Date /time	Ope rato
	System checkout in ambient conditions (RT+Pr – Before Test)			
4.07	Start the Bigmac data acquisition system.			
4.08	Set the data acquisition interval of Bigmac to 60 Sec			
4.09	Record temperatures			
4.10	Switch on the artificial light source [grey room of the bigmac]			
4.11	Switch on Power supply (CH1 +CH2) to Power ON E-Racks. All units should be ON now. (Will continue to be ON for the whole test, except for a reset test)	25.6V Input Current: Total Power:		
4.12	Confirm ICS FM-2 booting			
4.13	Confirm successful switch ON of PPD (both)			
4.14	Operation and functional check of ISLID	See		
4.15	Power consumption measurement			

Step no.	Action	Check/comments	Date /time	Operator
	System checkout in ambient conditions (RT+Pr – Before Test)			
4.16	HK data incl temperatures			
4.17	Data pipe line and data rate.			
4.18	Operation and functional check of CWS			
4.19	Power consumption measurement			
4.20	HK data incl temperatures			
4.21	Data pipe line and data rate.			
4.22	Operation and functional check of SUSI			
4.23	Power consumption measurement	Without heaters test.		
4.24	HK data incl temperatures			
4.25	Data pipe line and data rate.			
4.26	Switch OFF SUSI			
4.27	Operation and functional check of SCIP			
4.28	Power consumption measurement			
4.29	HK data incl temperatures			
4.30	Data pipe line and data rate.			
4.31	Switch OFF SCIP			
4.32	Operation and functional check of TuMag	With High Voltage		
4.33	Power consumption measurement			
4.34	HK data incl temperatures			
4.35	Data pipe line and data rate.			
4.36	Switch OFF TuMag			
4.37	Record ICS pressure and RH values.	PR: RH:		
4.38	Simultaneous operation of all 3 units SUSI + SCIP + TuMag			
4.39	Switch on SUSI			

Step no.	Action	Check/comments	Date /time	Ope rato
	System checkout in ambient conditions (RT+Pr – Before Test)			
4.40	Switch on SCIP			
4.41	Switch on TuMag			
4.42	Tests with all x3 instruments			
4.43	Switch OFF SCIP			
4.44	Switch OFF TuMag			
4.45	SUSI heaters test.			
4.46	Switch OFF SUSI			
4.47	Switch off CWS and ISLID			
4.48	Switch off the power supply for E-racks.			

15.4.3 FINISHING THE TEST

Step no.	Action	Check/comments	Date /time	Ope rato
	Finishing the test			
4.49	Stop the data acquisition at Bigmac			
4.50	Save the data from Bigmac to project folder.			
4.51	Update the Bigmac chamber logbook (at the holder on the wall)			
4.52	Carefully remove harness			
4.53	Carefully remove TuMag ELEL unit from the base plate.			
4.54	Carefully unmount the PFI using a crane and mount it on dolly. Move it to ISO-8 cleanroom	See § 10.1.2		
4.55	Remove EGSE and store them safely/move it to ISO8 hall			
4.56	Remove MGSE and pack + store them safely			
4.57	Close the Bigmac Chamber cleanroom door and move the PFI into ISO8 hall			

16 PROCEDURE DEVIATION LIST

Table 16.1: Procedure deviation list

Step No.	Deviation	Reason	Initiator signature	Approver Signature