



Instrumentation Plan

Herschel

Title: **Instrumentation Plan for Mechanical Testing of H-EPLM FM**

CI-No: 120000

Prepared by:	<u>B. Kettner</u> <i>B. Kettner</i>	Date:	<u>26 / 10 / 2007</u>
Checked by:	<u>J. Kroeker</u> <i>J. Kroeker</i>		<u>2. 11. 2007</u>
Product Assurance:	<u>R. Stritter</u> <i>R. Stritter</i>		<u>03. 11. 07</u>
Configuration Control:	<u>W. Wietbrock</u> <i>W. Wietbrock</i>		<u>05. 11. 07</u>
Project Management:	<u>Dr. W. Fricke</u> <i>W. Fricke</i>		<u>05/11/2007</u>

Distribution: See Distribution List (last page)

Copying of this document, and giving it to others and the use or communication of the contents thereof, are forbidden without express authority. Offenders are liable to the payment of damages. All rights are reserved in the event of the grant of a patent or the registration of a utility model or design.

Issue	Date	Sheet	Description of Change	Release
1	18.04.05		1st complete issue	
2	30.11.05		<p>2nd issue:</p> <p>For better readability, changes are not tracked.</p> <p>Accelerometers added on HSS Struts 02, 04, 05, 07, 09, 11 (local lateral in strut middle)</p> <p>Strain gauge definition on HSS Short Struts updated (now provided by Dutch Space, linear axial, ¼ bridge)</p> <p>HSS instrumentation partially updated acc. to DS recommendations; see HP-2-DSSA-PL-0016. Several tri-ax sensors moved into panel orientation. Corresponding DS designations included in the table.</p> <p>Three TMD accelerometers moved (as per unit qualification test HP-2-PROT-RP-0034: Y7 instead of Y5, Y6 instead of Y2, Z3 instead of Z2)</p> <p>Waveguide accelerometers PAWAVG001Y and PAWAVG001Z split on two waveguides</p> <p>LOR accelerometer position defined to match CoG position</p> <p>SVM Thermal Shield accelerometer positions modified to match unit acoustic test</p> <p>MP setup for acoustic and sine harmonized (thereby adding several CC + CB accelerometers to the sine MP definition)</p> <p>TMS strain gauges updated: Only one s/g per strut is bonded. This reduction is driven by the s/g channel limit and justified because of the high bending frequency of the CFRP struts</p> <p>Wiring schematic for strain-gauges added</p> <p>Gauge factor table added in annex B</p> <p>Chapter on test harness routing added</p>	

Issue	Date	Sheet	Description of Change	Release
3	28.02.07	all	<p>Update for FM test campaign:</p> <p>Update in figures and tables not tracked by sidebar.</p> <p>A new section 3.8 was added discussing post-test access. Also, a new section 4.1 was added giving justifications for elimination of sensors. The table containing the instrumentation list in section 4.2 was updated. Deleted sensors are marked as "omitted" in the table.</p> <p>Following figures were changed:</p> <ul style="list-style-type: none"> • LOU Support Structure updated • LOU Baffle accelerometers added • TMS updated • TEL Dummy removed • CVV UB STR sensor removed • CB and CC figures updated • CVV external updated 	
4	08.05.07	All	<p>Updates to indicate expected temperature range and integration slot for mechanical instrumentation.</p> <p>PACS FM Cryo sensors were removed due to missing I/F on PACS FPU (figure deleted)</p> <p>TMS sensors were moved and new sensors on long TMS struts added acc. to ESA requests.</p> <p>Harness routing concept sketches for HSS and HSS Struts included in Annex C.</p>	
5	26.10.07	p. 8 p. 42 §4.2	<p>Update of applicable and reference documents</p> <p>Accelerometer PANOZL002 XYZ added on external Nozzle Tube Bracket. (Fig. 5-10b)</p> <p>Table updated w.r.t. new accel. and new accel. type (PCB356M131). Update measurement point statistic.</p>	

Table of Contents

1	Scope	7
2	References	8
2.1	Applicable Documents	8
2.2	Reference Documents	8
3	Comments and explanations	9
3.1	Measurement points designation	9
3.2	Sensor types	9
3.3	Early instrumentation and accessibility constraints	10
3.4	Electrical connection of strain gauges	11
3.5	Calibration Factors for strain gauges	12
3.6	Time slots for application of sensors	12
3.7	Test harness routing	13
3.8	Post FM acceptance test activities	13
4	Instrumentation List	15
4.1	Justification for deletion of STM sensors	15
4.2	H-EPLM FM instrumentation list	17
5	Annex A: Position of Measurement Points	31
5.1	Internal Cryostat Accelerometers	31
5.2	HSS instrumentation	36
5.3	External EPLM instrumentation	40
6	Annex B: Strain-gauge definitions	51
7	Annex C: Test harness routing	52

Table of Figures

Figure 3-1: Quarter bridge schematic 11

Figure 3-2: Full bridge schematic 12

Figure 5-1: HTT accelerometers 31

Figure 5-2: HTT accelerometers (cont) 32

Figure 5-3: OBA Optical Bench Plate shown from below 33

Figure 5-4: TS1 Upper Bulkhead 34

Figure 5-5: HOT accelerometers 35

Figure 5-6: Solar Array Panels 36

Figure 5-7: Sunshade Panels..... 37

Figure 5-8: Solar Array Struts..... 38

Figure 5-9: Sunshade Struts..... 39

Figure 5-10: CVV external accelerometers 41

Figure 5-11: Cryostat Cover..... 43

Figure 5-12: Cryostat Baffle..... 43

Figure 5-13: LOU Radiator 44

Figure 5-14: LOU Support Structure (shown with External LOU Baffle)..... 45

Figure 5-15: LOU Baffle I/F (baffle not shown)..... 45

Figure 5-16: LOU sensors (shown here on MTD)..... 46

Figure 5-17: LOU Waveguides 47

Figure 5-18: SVM/PLM Struts..... 48

Figure 5-19: SVM Thermal Shield..... 49

Figure 5-20: Telescope Mounting Structure, TMS 50

Figure 7-1: Test harness routing HSS Struts 52

Figure 7-2: Test harness routing Sunshade..... 53

Figure 7-3: Test harness routing Solar Array54

List of Tables

Table 3-1: MP designation scheme9

Table 3-2: Sensors omitted since issue 1:10

1 Scope

This document defines the H-EPLM (excluded telescope) instrumentation for mechanical acceptance tests

- Sine vibration test
- Acoustic noise test
- Microvibration test

to be performed on the Herschel FM.

2 References

2.1 Applicable Documents

AD #	Document Title	Document Identifier	Issue
AD 01	Herschel FM Mechanical Test Specification	H-P-2-ASP-SP-1415	1
AD 02	Herschel FM Microvibration Test Specification	H-P-2-ASP-SP-1280	1
AD 03	Herschel FM Mechanical Instrumentation	H-P-2-ASP-SP-1337	3

2.2 Reference Documents

RD #	Document Title	Document Identifier	Issue
RD 01	Leading Procedure for Herschel S/C FM Mechanical Tests	HP-2-ASED-TP-0059	tbi
RD 02	Sine Vibration Test Procedure for Herschel FM	HP-2-ASED-TP-0060	tbi
RD 03	Acoustic Noise Test Procedure for Herschel FM	HP-2-ASED-TP-0061	tbi
RD 04	Microvibration Test Procedure for Herschel FM	HP-2-ASED-TP-0063	tbi
RD 05	Herschel FM S/C Accel. Instrumentation Report	HP-2-ASED-RP-0243	Current issue

3 Comments and explanations

3.1 Measurement points designation

A unique string of 10 characters is assigned to the measurement points according to the following scheme:

Table 3-1: MP designation scheme

Digits	Fields	Content
1	Module designation	H - S/C S - SVM P - EPLM
1	Type of measurement	A - accelerometer S - strain gauge
4	Unit designation	e.g. "CVV-", "SA-S"
3	Unique number	e.g. 003
1	Measurement direction	X, Y, Z - global S/C O - local out-of-plane A - axial (e.g. strut direction) L - local lateral P - local perpendicular to "L"

Examples:

1234567890
PACSTR010X
PALOUR002X

This definition is compatible with the universal file format version 58 convention.

SVM measurement points follow their own designation logic.

3.2 Sensor types

The instrumentation described in this document will be used for the mechanical tests described in the individual test specifications [RD2] to [RD5].

Apart from the exceptions noted in the document, ETS will provide the instrumentation.

Internal accelerometers are of the type Endevco 2272. For external accelerometers the accelerometer type is mainly passive.

The strain gauge type is Vishay CEA, Constantan (K-factor=2.105 resp. 2.130 depending on temperature compensation type), 350Ω, linear resp. Tee Rosettes, 1/4" section length. Quarter-bridge gauges will be connected via 3-conductor leads to compensate cable length; full-bridges with 4-conductor leads. Epoxy glue will be used for bonding strain-gauges (M-Bond AE-10).

3.3 Early instrumentation and accessibility constraints

Internal cryostat accelerometers are not accessible. They are bolt-mounted to the cryostat structure. The harness is routed as part of the CCH. The interface to the data acquisition is at two positions of the CVV Cylinder (vacuum feed-throughs P02 on the lower ring and P38 on the upper ring). A dedicated test harness with Microdot 10-32 connectors to the ETS data acquisition will be provided by ASED.

The area between CVV and HSS (+Z side of H-EPLM) is difficult to access due to the HSS horizontal stiffener and the strut array. Due to poor accessibility the following sensors on the CVV were omitted already for the STM test campaign:

Table 3-2: Sensors omitted since issue 1:

MP ID	Type	Location
PACVVU004X	omitted	Upper CVV Ring, +Z position, STA 2222
PACVVU004Y	omitted	Upper CVV Ring, +Z position, STA 2222
PACVVL009X	omitted	Lower CVV Ring, +Z position, STA 544
PACVVL009Y	omitted	Lower CVV Ring, +Z position, STA 544

Strut MLI vs. strain gauge harness: It is foreseen to cut the S/G cables after acceptance test completion at the strut end such that the cable stays in place and the MLI does not have to be removed.

3.4 Electrical connection of strain gauges

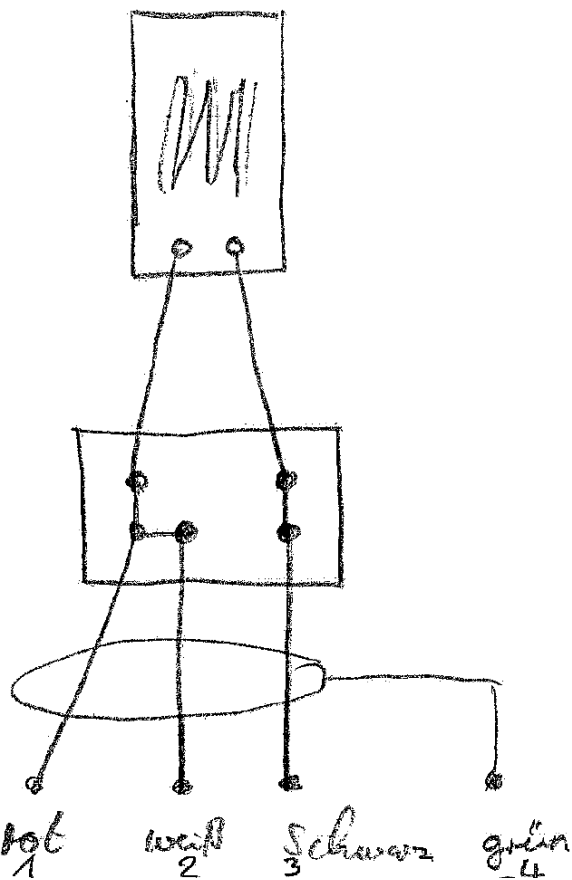
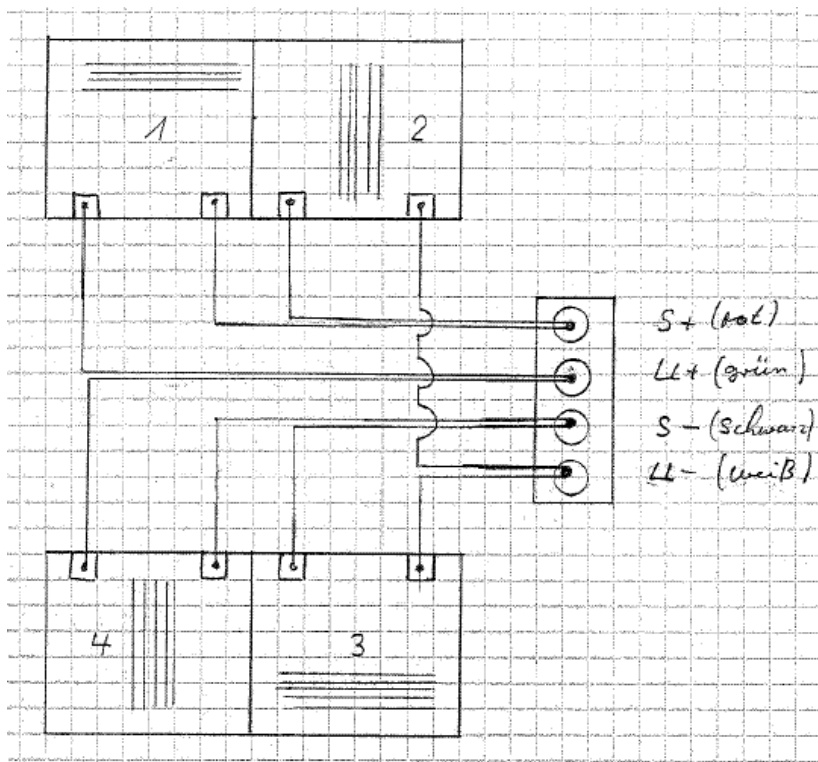


Figure 3-1: Quarter bridge schematic



Wire	Colour
Voltage Supply +	Red
Signal +	Green
Voltage Supply -	Black
Signal -	White

Figure 3-2: Full bridge schematic

3.5 Calibration Factors for strain gauges

See Annex B.

3.6 Time slots for application of sensors

For the H-EPLM, the access constraints are not as complex as for the SVM. However, there is a need to plan the sensor application ahead of time. For this purpose, additional column are introduced in the sensor list in chapter 4.2, which indicate the foreseen application slot:

- "FN" denotes that the sensors were or will be applied in Friedrichshafen during the FM AIT sequence (after S/C mating, before final MLI closure). Expected time frame for completion: June 2007
- "DS" denotes that the sensors will be applied under Dutch Space responsibility as part of the HSS FM unit acceptance test campaign; presumably at ESTEC facilities. Expected time frame: July/August 2007

- "Vib" denotes that the sensors will be applied after the FM thermal vacuum test immediately before the mechanical tests at ESTEC facilities. Expected time frame: 1st half of March 2008

3.7 Test harness routing

It is foreseen to route all sensor cables along the satellite to an area on the SVM Upper Closure Panel in the -Y segment (to either side of the waveguides). This will allow to connect all cables to the data acquisition.

See sketches in Annex C.

3.8 Post FM acceptance test activities

Due to schedule and access constraints, it is worthwhile to plan post-test activities well in advance. After successful test completion, the following instrumentation removal activities are necessary to put the S/C into flight configuration:

Strain-gauges:

The s/g cables shall be cut off as close as possible to the gauge. The cables shall be removed completely from the S/C. The gauges stay on the S/C, as the removal may lead to damage of the sub-structure. Those sensors are marked with "SG" in the column "flight standard" in section 4.2.

Internal accelerometers:

The test harness for internal accelerometers will be disconnected at the CVV feed-through and removed from the S/C. Flight caps will be installed and secured on the feed-throughs. Those sensors are marked with "CRYO" in the column "flight standard" in section 4.2.

External accelerometers:

As far as possible, accelerometers will be detached together with cable. Those sensors are marked with "N" in the column "flight standard" in section 4.2.

In case of poor access, the cable shall be cut off at the most suitable location and electrically grounded to avoid EMC problems. In this case, sensor and cable are specially treated for vacuum conditions prior to installation. Those sensors are marked with "Y" in the column "flight standard" in section 4.2.

In addition, HSS sensors foreseen for unit protoflight testing have to be suitable for exposure to thermal vacuum conditions (S/C FM acceptance test in LSS). Those sensors are marked with "Y" in the column "vacuum standard" in section 4.2.

Note:

The above reflects the current baseline scenario of thermal vacuum test before mechanical tests. For a reversed acceptance test sequence, the instrumentation approach must be revised.

4 Instrumentation List

4.1 Justification for deletion of STM sensors

TEL dummy: 8 channels deleted

The TEL dummy will not be used for the FM test. FM telescope instrumentation will be defined by AAS-F resp. ASEF.

Cryostat Cover: 7 channels deleted

During STM test the flight spare Cryo Cover mounted onto the flight spare CVV Top Plate was used. The loads observed during all STM tests were comfortably below the unit qualification loads. In addition, the CC sensors were never used for notch/limiter channels. Thus, for the reduced acceptance test environment, no problems are expected. The instrumentation is reduced to one tri-ax sensor close to the CC I/F to CVV to monitor overall acceleration levels.

Cryostat Baffle: 2 channels deleted

During STM test the PFM Cryo Cover mounted onto the flight spare CVV Top Plate was used. The loads observed during all STM tests were comfortably below the unit qualification loads. In addition, the CB sensors were never used for notch/limiter channels. Thus, for the reduced acceptance test environment, no problems are expected. The instrumentation is reduced to one single axis sensor on top to monitor acoustic levels.

External CVV LHe-valve sensors: 12 channels deleted

The number of additional sensors on the external helium valves introduced for the STM acoustic noise test is reduced to a reasonable level. The sensor location on the highest loaded valve is retained (PACVVV400XTO and PACVVV401XTO).

STR I/F on CVV: 3 channels deleted

The three channels on the CVV STR I/F are particularly difficult to mount and dismount due to access from the inside of the SVM cone and the MLI constraints. Since the measurements during STM indicated moderate levels and the sensors were not used for notch/limiter definitions, the sensors are proposed for deletion.

Retained sensors

Instrumentation of the following parts is to a large extent taken over from STM:

- HSS (needed to verify HSS FM)
- HSS Struts (needed to verify HSS FM)
- TMS (needed to monitor TEL loads)
- LOU (to verify LOU issues as per NC-1984)
- External CVV and SVM Thermal shield (basically no changes; needed to provide global responses; good access)

4.2 H-EPLM FM instrumentation list

MP ID	Type	Location	Direction X/Y/Z	Usage			Expected max lev.	Time slot	Temp. range	Flight stand.	Vacuum stand.	Remark
				sine	A/N	μ-vib						
Internal												
PACRYO101X	accelerometer	HTT Upper BH	X	y	y		15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO102Y	accelerometer	HTT Upper BH	Y	y	y		15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO103Z	accelerometer	HTT Upper BH	Z	y	y		15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO104X	accelerometer	HTT Lower BH	X	y	y		15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO105Y	accelerometer	HTT Lower BH	Y	y	y		15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO106Z	accelerometer	HTT Lower BH	Z	y	y		15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO107X	accelerometer	HTT Upper BH	X	y	y		15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO108Z	accelerometer	HTT Lower BH	Z	y	y		15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO109Y	accelerometer	HTT Lower BH	Y	y	y		15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO201X	accelerometer	OBA	X	y	y	y	15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO202Y	accelerometer	OBA	Y	y	y	y	15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO203Z	accelerometer	OBA	Z	y	y	y	15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO204X	accelerometer	OBA	X	y	y	y	15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO205Z	accelerometer	OBA	Z	y	y	y	15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO206Y	accelerometer	OBA	Y	y	y	y	15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO207Y	omitted	PACS FPU	Y	y	y			n/a	n/a	n/a	n/a	no I/F on PACS FM
PACRYO208Z	omitted	PACS FPU	Z	y	y			n/a	n/a	n/a	n/a	no I/F on PACS FM
PACRYO421X	accelerometer	1st Shield	X	y	y		15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO422Z	accelerometer	1st Shield	Z	y	y		15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO701X	accelerometer	HOT Upper BH	X	y	y		15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO702Y	accelerometer	HOT Upper BH	Y	y	y		15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
PACRYO703Z	accelerometer	HOT Upper BH	Z	y	y		15 g	FN	2K to RT	CRYO	CRYO	Endevco 2272
HSS Panels												
PAHSSP001X	accelerometer	Top of Sunshade	X	y	y		100 g	DS	-55°C to RT	N	Y	DAP5--017XTO
PAHSSP001Y	accelerometer	Top of Sunshade	Y	y	y		100 g	DS	-55°C to RT	N	Y	

MP ID	Type	Location	Direction X/Y/Z	Usage			Expected max lev.	Time slot	Temp. range	Flight stand.	Vacuum stand.	Remark
				sine	A/N	μ-vib						
PAHSSP001Z	accelerometer	Top of Sunshade	Z	y	y		100 g	DS	-55°C to RT	N	Y	
PAHSSP002Z	accelerometer	Top of Sunshade mid-panel	Z	y	y		100 g	DS	-55°C to RT	Y	Y	DAP5--008O
PAHSSP003O	accelerometer	-Y side of Sunshade	O	y	y		100 g	DS	-55°C to RT	N	Y	DAP4--013O
PAHSSP004O	accelerometer	+Y side of Sunshade mid-panel	O	y	y		100 g	DS	-55°C to RT	N	Y	DAP6--015O
PAHSSP005X	accelerometer	-Y side of Sunshade	X	y	y		100 g	DS	-55°C to RT	N	Y	DAP4--009TO
PAHSSP005T	accelerometer	-Y side of Sunshade	T	y	y		100 g	DS	-55°C to RT	N	Y	
PAHSSP005O	accelerometer	-Y side of Sunshade	O	y	y		100 g	DS	-55°C to RT	N	Y	
PAHSSP006X	accelerometer	+Y side of Sunshade	X	y	y		100 g	DS	-55°C to RT	N	Y	
PAHSSP006T	accelerometer	+Y side of Sunshade	T	y	y		100 g	DS	-55°C to RT	N	Y	DAP6--012TO
PAHSSP006O	accelerometer	+Y side of Sunshade	O	y	y		100 g	DS	-55°C to RT	N	Y	
PAHSSP007X	accelerometer	-Y side of Sunshade near Horizontal Stiffener	X	y	y		50 g	DS	-55°C to RT	N	Y	no DS sensor
PAHSSP007T	accelerometer	-Y side of Sunshade near Horizontal Stiffener	T	y	y		50 g	DS	-55°C to RT	N	Y	
PAHSSP007O	accelerometer	-Y side of Sunshade near Horizontal Stiffener	O	y	y		50 g	DS	-55°C to RT	N	Y	
PAHSSP008Z	accelerometer	Sunshade mid panel below Horizontal Stiffener	Z	y	y		50 g	DS	-55°C to RT	Y	Y	DAP5-002XTO
PAHSSP009T	accelerometer	+Y side of Sunshade near Horizontal Stiffener	T	y	y		50 g	DS	-55°C to RT	N	Y	no DS sensor
PAHSSP009O	accelerometer	+Y side of Sunshade near Horizontal Stiffener	O	y	y		50 g	DS	-55°C to RT	N	Y	
PAHSSP101X	accelerometer	-Y side of Solar Array, near upper hor.stiff.	X	y	y		50 g	DS	-30°C to 155°C	N	Y	DAP1--021TO
PAHSSP101T	accelerometer	-Y side of Solar Array, near upper hor.stiff.	T	y	y		50 g	DS	-30°C to 155°C	N	Y	
PAHSSP101O	accelerometer	-Y side of Solar Array, near upper hor.stiff.	O	y	y		50 g	DS	-30°C to 155°C	N	Y	
PAHSSP102Y	accelerometer	Solar Array, near upper hor.stiff., mid-panel	Y	y	y		50 g	DS	-30°C to 155°C	Y	Y	DAP2--023O
PAHSSP102Z	accelerometer	Solar Array, near upper hor.stiff., mid-panel	Z	y	y		50 g	DS	-30°C to 155°C	Y	Y	
PAHSSP103X	accelerometer	+Y side of Solar Array, near upper hor.stiff.	X	y	y		50 g	DS	-30°C to 155°C	N	Y	DAP3--025TO

MP ID	Type	Location	Direction	Usage			Expected	Time	Temp.	Flight	Vacuum	Remark
			X/Y/Z	sine	A/N	μ-vib	max lev.	slot	range	stand.	stand.	
PAHSSP103T	accelerometer	+Y side of Solar Array, near upper hor.stiff.	T	y	y		50 g	DS	-30°C to 155°C	N	Y	
PAHSSP103O	accelerometer	+Y side of Solar Array, near upper hor.stiff.	O	y	y		50 g	DS	-30°C to 155°C	N	Y	
PAHSSP104T	accelerometer	Solar Array, -Y side	T	y	y		50 g	DS	-30°C to 155°C	N	Y	DAP1--011O
PAHSSP104O	accelerometer	Solar Array, -Y side	O	y	y		50 g	DS	-30°C to 155°C	N	Y	
PAHSSP105Z	accelerometer	Solar Array, panel centre	Z	y	y		50 g	DS	-30°C to 155°C	Y	Y	DAP2--013O
PAHSSP106T	accelerometer	Solar Array, +Y side	T	y	y		50 g	DS	-30°C to 155°C	N	Y	DAP3-0015O
PAHSSP106O	accelerometer	Solar Array, +Y side	O	y	y		50 g	DS	-30°C to 155°C	N	Y	
PAHSSP107X	accelerometer	Solar Array, near lower hor.stiff., -Y side, outer corner	X	y	y		50 g	DS	-30°C to 155°C	N	Y	DAP1--001XTO
PAHSSP107T	accelerometer	Solar Array, near lower hor.stiff., -Y side, outer corner	T	y	y		50 g	DS	-30°C to 155°C	N	Y	
PAHSSP107O	accelerometer	Solar Array, near lower hor.stiff., -Y side, outer corner	O	y	y		50 g	DS	-30°C to 155°C	N	Y	
PAHSSP108X	accelerometer	Solar Array, near lower hor.stiff., +Y side, outer corner	X	y	y		50 g	DS	-30°C to 155°C	N	Y	DAP3--005XTO
PAHSSP108T	accelerometer	Solar Array, near lower hor.stiff., +Y side, outer corner	T	y	y		50 g	DS	-30°C to 155°C	N	Y	
PAHSSP108O	accelerometer	Solar Array, near lower hor.stiff., +Y side, outer corner	O	y	y		50 g	DS	-30°C to 155°C	N	Y	
HSS Struts												
PASA-S001L	accelerometer	Solar Array Strut 01, local lateral Y	Y'	y	y		70 g	DS	-70°C to +80°C	N	Y	PCB356M131
PASA-S001P	accelerometer	Solar Array Strut 01, local lateral Z	Z'	y	y		70 g	DS	-70°C to +80°C	N	Y	"
PASA-S002L	accelerometer	Solar Array Strut 02, local lateral Y	Y'	y	y		70 g	DS	-70°C to +80°C	N	Y	PCB356M131
PASA-S002P	accelerometer	Solar Array Strut 02, local lateral Z	Z'	y	y		70 g	DS	-70°C to +80°C	N	Y	"
PASA-S003L	accelerometer	Solar Array Strut 03, local lateral Y	Y'	y	y		70 g	DS	-70°C to +80°C	N	Y	PCB356M131

MP ID	Type	Location	Direction	Usage			Expected	Time	Temp.	Flight	Vacuum	Remark
				X/Y/Z	sine	A/N						
PASA-S003P	accelerometer	Solar Array Strut 03, local lateral Z	Z'	y	y		70 g	DS	-70°C to +80°C	N	Y	"
PASA-S004L	accelerometer	Solar Array Strut 04, local lateral Y	Y'	y	y		70 g	DS	-70°C to +80°C	N	Y	PCB356M131
PASA-S004P	accelerometer	Solar Array Strut 04, local lateral Z	Z'	y	y		70 g	DS	-70°C to +80°C	N	Y	"
PASA-S005L	accelerometer	Solar Array Strut 05, local lateral Y	Y'	y	y		70 g	DS	-70°C to +80°C	N	Y	PCB356M131
PASA-S005P	accelerometer	Solar Array Strut 05, local lateral Z	Z'	y	y		70 g	DS	-70°C to +80°C	N	Y	"
PASA-S006L	accelerometer	Solar Array Strut 06, local lateral Y	Y'	y	y		70 g	DS	-70°C to +80°C	Y	Y	PCB356M131
PASA-S006P	accelerometer	Solar Array Strut 06, local lateral Z	Z'	y	y		70 g	DS	-70°C to +80°C	Y	Y	"
PASA-S007L	accelerometer	Solar Array Strut 07, local lateral Y	Y'	y	y		70 g	DS	-70°C to +80°C	Y	Y	PCB356M131
PASA-S007P	accelerometer	Solar Array Strut 07, local lateral Z	Z'	y	y		70 g	DS	-70°C to +80°C	Y	Y	"
PASA-S008L	accelerometer	Solar Array Strut 08, local lateral Y	Y'	y	y		70 g	DS	-70°C to +80°C	N	Y	PCB356M131
PASA-S008P	accelerometer	Solar Array Strut 08, local lateral Z	Z'	y	y		70 g	DS	-70°C to +80°C	N	Y	"
PASSDS009L	accelerometer	Sunshade Strut 09, local lateral Y	Y'	y	y		70 g	DS	-120°C to +80°C	N	Y	PCB356M131
PASSDS009P	accelerometer	Sunshade Strut 09, local lateral Z	Z'	y	y		70 g	DS	-120°C to +80°C	N	Y	"
PASSDS010L	accelerometer	Sunshade Strut 10, local lateral Y	Y'	y	y		70 g	DS	-120°C to +80°C	Y	Y	PCB356M131
PASSDS010P	accelerometer	Sunshade Strut 10, local lateral Z	Z'	y	y		70 g	DS	-120°C to +80°C	Y	Y	"
PASSDS011L	accelerometer	Sunshade Strut 11, local lateral Y	Y'	y	y		70 g	DS	-120°C to +80°C	Y	Y	PCB356M131
PASSDS011P	accelerometer	Sunshade Strut 11, local lateral Z	Z'	y	y		70 g	DS	-120°C to +80°C	Y	Y	"
PASSDS012L	accelerometer	Sunshade Strut 12, local lateral Y	Y'	y	y		70 g	DS	-120°C to +80°C	N	Y	PCB356M131

MP ID	Type	Location	Direction	Usage			Expected	Time	Temp.	Flight	Vacuum	Remark
			X/Y/Z	sine	A/N	μ-vib	max lev.	slot	range	stand.	stand.	
PASSDS012P	accelerometer	Sunshade Strut 12, local lateral Z	Z'	y	y		70 g	DS	-120°C to +80°C	N	Y	"
PSSA-S011A	strain gauge	Solar Array Strut 01, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S012A	strain gauge	Solar Array Strut 01, -120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S013A	strain gauge	Solar Array Strut 01, +120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S021A	strain gauge	Solar Array Strut 02, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S022A	strain gauge	Solar Array Strut 02, -120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S023A	strain gauge	Solar Array Strut 02, +120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S031A	strain gauge	Solar Array Strut 03, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S032A	strain gauge	Solar Array Strut 03, -120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S033A	strain gauge	Solar Array Strut 03, +120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S041A	strain gauge	Solar Array Strut 04, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S042A	strain gauge	Solar Array Strut 04, -120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S043A	strain gauge	Solar Array Strut 04, +120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S051A	strain gauge	Solar Array Strut 05, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S052A	strain gauge	Solar Array Strut 05, -120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S053A	strain gauge	Solar Array Strut 05, +120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S061A	strain gauge	Solar Array Strut 06, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S062A	strain gauge	Solar Array Strut 06, -120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S063A	strain gauge	Solar Array Strut 06, +120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S071A	strain gauge	Solar Array Strut 07, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S072A	strain gauge	Solar Array Strut 07, -120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S073A	strain gauge	Solar Array Strut 07, +120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S081A	strain gauge	Solar Array Strut 08, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S082A	strain gauge	Solar Array Strut 08, -120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S083A	strain gauge	Solar Array Strut 08, +120°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSA-S091A	strain gauge	Short Solar Array Strut SB1, axial	X'	y	y			DS	n/a	SG	SG	quarter-bridge, provided by DS

MP ID	Type	Location	Direction	Usage			Expected	Time	Temp.	Flight	Vacuum	Remark	
				X/Y/Z	sine	A/N							μ-vib
PSSA-S101A	strain gauge	Short Solar Array Strut SB2, axial	X'	y	y				DS	n/a	SG	SG	quarter-bridge, provided by DS
PSSA-S111A	strain gauge	Short Solar Array Strut SB3, axial	X'	y	y				DS	n/a	SG	SG	quarter-bridge, provided by DS
PSSSDS091A	strain gauge	Sunshade Strut 09, 0°, axial dir.	X'	y	y				FN	n/a	SG	SG	quarter-bridge
PSSSDS092A	strain gauge	Sunshade Strut 09, -120°, axial dir.	X'	y	y				FN	n/a	SG	SG	quarter-bridge
PSSSDS093A	strain gauge	Sunshade Strut 09, +120°, axial dir.	X'	y	y				FN	n/a	SG	SG	quarter-bridge
PSSSDS101A	strain gauge	Sunshade Strut 10, 0°, axial dir.	X'	y	y				FN	n/a	SG	SG	quarter-bridge
PSSSDS102A	strain gauge	Sunshade Strut 10, -120°, axial dir.	X'	y	y				FN	n/a	SG	SG	quarter-bridge
PSSSDS103A	strain gauge	Sunshade Strut 10, +120°, axial dir.	X'	y	y				FN	n/a	SG	SG	quarter-bridge
PSSSDS111A	strain gauge	Sunshade Strut 11, 0°, axial dir.	X'	y	y				FN	n/a	SG	SG	quarter-bridge
PSSSDS112A	strain gauge	Sunshade Strut 11, -120°, axial dir.	X'	y	y				FN	n/a	SG	SG	quarter-bridge
PSSSDS113A	strain gauge	Sunshade Strut 11, +120°, axial dir.	X'	y	y				FN	n/a	SG	SG	quarter-bridge
PSSSDS121A	strain gauge	Sunshade Strut 12, 0°, axial dir.	X'	y	y				FN	n/a	SG	SG	quarter-bridge
PSSSDS122A	strain gauge	Sunshade Strut 12, -120°, axial dir.	X'	y	y				FN	n/a	SG	SG	quarter-bridge
PSSSDS123A	strain gauge	Sunshade Strut 12, +120°, axial dir.	X'	y	y				FN	n/a	SG	SG	quarter-bridge
TEL Mounting Structure													
PATMSF001X	accelerometer	TMS Frame on corner, -Z side	X	y	y		30 g		Vib	around RT	N	N	
PATMSF001Y	accelerometer	TMS Frame on corner, -Z side	Y	y	y		30 g		Vib	around RT	N	N	
PATMSF001Z	accelerometer	TMS Frame on corner, -Z side	Z	y	y		30 g		Vib	around RT	N	N	
PATMSF002X	accelerometer	TMS Frame on corner, +Y side	X	y	y		30 g		Vib	around RT	N	N	
PATMSF002Y	accelerometer	TMS Frame on corner, +Y side	Y	y	y		30 g		Vib	around RT	N	N	
PATMSF002Z	accelerometer	TMS Frame on corner, +Y side	Z	y	y		30 g		Vib	around RT	N	N	
PATMSF003X	accelerometer	TMS Frame on corner, -Y side	X	y	y		30 g		Vib	around RT	N	N	
PATMSF003Y	accelerometer	TMS Frame on corner, -Y side	Y	y	y		30 g		Vib	around RT	N	N	
PATMSF003Z	accelerometer	TMS Frame on corner, -Y side	Z	y	y		30 g		Vib	around RT	N	N	
PATMSF004X	accelerometer	TMS Frame near short strut I/F, -Y side	X	y	y		30 g		Vib	around RT	N	N	
PATMSF004O	accelerometer	TMS Frame near short strut I/F, -Y side	O	y	y		30 g		Vib	around RT	N	N	local oop
PSTMS041A	strain gauge	TMS Strut, 0°, axial dir., -Z	X'	y	y				FN	n/a	SG	SG	quarter-bridge

MP ID	Type	Location	Direction	Usage			Expected	Time	Temp.	Flight	Vacuum	Remark
				X/Y/Z	sine	A/N						
PSTMSS051A	strain gauge	TMS Strut, 0°, axial dir., -Z	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSTMSS061A	strain gauge	TMS Strut, 0°, axial dir., +Y	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSTMSS071A	strain gauge	TMS Strut, 0°, axial dir., +Y	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSTMSS081A	strain gauge	TMS Strut, 0°, axial dir., -Y	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSTMSS091A	strain gauge	TMS Strut, 0°, axial dir., -Y	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSTMSS101A	strain gauge	TMS CB Strut, 0°/180°, T-rosette 0/90	X'	y	y			FN	n/a	SG	SG	full-bridge, bending comp.
PSTMSS111A	strain gauge	TMS CB Strut, 0°/180°, T-rosette 0/90	X'	y	y			FN	n/a	SG	SG	full-bridge, bending comp.
LOU												
PALOUS001X	accelerometer	LOU CoG position	X	y	y		70 g	Vib	around RT	N	N	
PALOUS001Y	accelerometer	LOU CoG position	Y	y	y		70 g	Vib	around RT	N	N	
PALOUS001Z	accelerometer	LOU CoG position	Z	y	y		70 g	Vib	around RT	N	N	
PALOUS002X	accelerometer	LOU Baffle I/F position	X	y	y		70 g	Vib	around RT	N	N	
PALOUS002Y	accelerometer	LOU Baffle I/F position	Y	y	y		70 g	Vib	around RT	N	N	
PALOUS002Z	accelerometer	LOU Baffle I/F position	Z	y	y		70 g	Vib	around RT	N	N	
PALOUR002X	accelerometer	LOU Radiator CoG position	X	y	y		70 g	Vib	around RT	N	N	moved to hard point as for STM
PALOUR002Y	accelerometer	LOU Radiator CoG position	Y	y	y		70 g	Vib	around RT	N	N	
PALOUR002Z	accelerometer	LOU Radiator CoG position	Z	y	y		70 g	Vib	around RT	N	N	
PALOUR0030	accelerometer	LOU Radiator Corner local oop	oop (local)	y	y		100 g	Vib	around RT	N	N	
PSLOUS011A	strain gauge	LOU Strut, 0°/180°, T-rosette 0/90	X'	y	y			FN	n/a	SG	SG	NEW positioning!!!
PSLOUS021A	strain gauge	LOU Strut, 0°/180°, T-rosette 0/90	X'	y	y			FN	n/a	SG	SG	full-bridge, bending comp.
PSLOUS031A	strain gauge	LOU Strut, 0°/180°, T-rosette 0/90	X'	y	y			FN	n/a	SG	SG	full-bridge, bending comp.
PSLOUS041A	strain gauge	LOU Strut, 0°/180°, T-rosette 0/90	X'	y	y			FN	n/a	SG	SG	full-bridge, bending comp.

MP ID	Type	Location	Direction	Usage			Expected	Time	Temp.	Flight	Vacuum	Remark
				X/Y/Z	sine	A/N						
PSSLOUS051A	strain gauge	LOU Strut, 0°/180°, T-rosette 0/90	X'	y	y			FN	n/a	SG	SG	full-bridge, bending comp.
PSSLOUS061A	strain gauge	LOU Strut, 0°/180°, T-rosette 0/90	X'	y	y			FN	n/a	SG	SG	full-bridge, bending comp.
PSSLOUS071A	strain gauge	LOU Strut, 0°/180°, T-rosette 0/90	X'	y	y			FN	n/a	SG	SG	full-bridge, bending comp.
PSSLOUS081A	strain gauge	LOU Strut, 0°/180°, T-rosette 0/90	X'	y	y			FN	n/a	SG	SG	full-bridge, bending comp.
SVM/PLM Struts												
PSSVMS011A	strain gauge	SVM Strut +Y, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSVMS012A	strain gauge	SVM Strut +Y, -120°, axial dir.	X'					FN	n/a	SG	SG	quarter-bridge, contingency
PSSVMS013A	strain gauge	SVM Strut +Y, +120°, axial dir.	X'					FN	n/a	SG	SG	quarter-bridge, contingency
PSSVMS021A	strain gauge	SVM Strut +Y, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSVMS022A	strain gauge	SVM Strut +Y, -120°, axial dir.	X'					FN	n/a	SG	SG	quarter-bridge, contingency
PSSVMS023A	strain gauge	SVM Strut +Y, +120°, axial dir.	X'					FN	n/a	SG	SG	quarter-bridge, contingency
PSSVMS031A	strain gauge	SVM Strut -Y, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSVMS032A	strain gauge	SVM Strut -Y, -120°, axial dir.	X'					FN	n/a	SG	SG	gauge broken, no signal
PSSVMS033A	strain gauge	SVM Strut -Y, +120°, axial dir.	X'					FN	n/a	SG	SG	quarter-bridge, contingency
PSSVMS041A	strain gauge	SVM Strut -Y, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSVMS042A	strain gauge	SVM Strut -Y, -120°, axial dir.	X'					FN	n/a	SG	SG	quarter-bridge, contingency
PSSVMS043A	strain gauge	SVM Strut -Y, +120°, axial dir.	X'					FN	n/a	SG	SG	quarter-bridge, contingency
PSSVMS051A	strain gauge	SVM Strut +Z, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSVMS052A	strain gauge	SVM Strut +Z, -120°, axial dir.	X'					FN	n/a	SG	SG	quarter-bridge, contingency

MP ID	Type	Location	Direction	Usage			Expected	Time	Temp.	Flight	Vacuum	Remark
				X/Y/Z	sine	A/N						
PSSVMS053A	strain gauge	SVM Strut +Z, +120°, axial dir.	X'					FN	n/a	SG	SG	quarter-bridge, contingency
PSSVMS061A	strain gauge	SVM Strut +Z, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSVMS062A	strain gauge	SVM Strut +Z, -120°, axial dir.	X'					FN	n/a	SG	SG	quarter-bridge, contingency
PSSVMS063A	strain gauge	SVM Strut +Z, +120°, axial dir.	X'					FN	n/a	SG	SG	quarter-bridge, contingency
PSSVMS071A	strain gauge	SVM Strut -Z, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSVMS072A	strain gauge	SVM Strut -Z, -120°, axial dir.	X'					FN	n/a	SG	SG	quarter-bridge, contingency
PSSVMS073A	strain gauge	SVM Strut -Z, +120°, axial dir.	X'					FN	n/a	SG	SG	quarter-bridge, contingency
PSSVMS081A	strain gauge	SVM Strut -Z, 0°, axial dir.	X'	y	y			FN	n/a	SG	SG	quarter-bridge
PSSVMS082A	strain gauge	SVM Strut -Z, -120°, axial dir.	X'					FN	n/a	SG	SG	quarter-bridge, contingency
PSSVMS083A	strain gauge	SVM Strut -Z, +120°, axial dir.	X'					FN	n/a	SG	SG	quarter-bridge, contingency
External CVV												
PACVVU001X	accelerometer	Upper CVV Ring, -Y position, STA 2222	X	y	y		15 g	Vib	around RT	N	N	
PACVVU001Z	accelerometer	Upper CVV Ring, -Y position, STA 2222	Z	y	y		15 g	Vib	around RT	N	N	
PACVVU002X	accelerometer	Upper CVV Ring, -Z position, STA 2222	X	y	y		15 g	Vib	around RT	N	N	
PACVVU002Y	accelerometer	Upper CVV Ring, -Z position, STA 2222	Y	y	y		15 g	Vib	around RT	N	N	
PACVVU003X	accelerometer	Upper CVV Ring, +Y position, STA 2222	X	y	y		15 g	Vib	around RT	N	N	
PACVVU003Z	accelerometer	Upper CVV Ring, +Y position, STA 2222	Z	y	y		15 g	Vib	around RT	N	N	
PACVVU004X	omitted	Upper CVV Ring, +Z position, STA 2222	X					n/a	n/a	n/a	n/a	position not accessible on FM
PACVVU004Y	omitted	Upper CVV Ring, +Z position, STA 2222	Y					n/a	n/a	n/a	n/a	position not accessible on FM
PACVVB005X	accelerometer	Cryostat Baffle I/F near Solar Array Strut	X	y	y		15 g	Vib	around RT	N	N	
PACVVB005Y	accelerometer	Cryostat Baffle I/F near Solar Array Strut	Y	y	y		15 g	Vib	around RT	N	N	
PACVVB005Z	accelerometer	Cryostat Baffle I/F near Solar Array Strut	Z	y	y		15 g	Vib	around RT	N	N	

MP ID	Type	Location	Direction	Usage			Expected	Time	Temp.	Flight	Vacuum	Remark
				X/Y/Z	sine	A/N						
PACVVL006X	accelerometer	Lower CVV Ring, -Y position, STA 544	X	y	y		15 g	Vib	around RT	N	N	
PACVVL006Z	accelerometer	Lower CVV Ring, -Y position, STA 544	Z	y	y		15 g	Vib	around RT	N	N	
PACVVL007X	accelerometer	Lower CVV Ring, -Z position, STA 544	X	y	y		15 g	Vib	around RT	N	N	
PACVVL007Y	accelerometer	Lower CVV Ring, -Z position, STA 544	Y	y	y		15 g	Vib	around RT	N	N	
PACVVL008X	accelerometer	Lower CVV Ring, +Y position, STA 544	X	y	y		15 g	Vib	around RT	N	N	
PACVVL008Z	accelerometer	Lower CVV Ring, +Y position, STA 544	Z	y	y		15 g	Vib	around RT	N	N	
PACVVL009X	omitted	Lower CVV Ring, +Z position, STA 544	X					n/a	n/a	n/a	n/a	position not accessible on FM
PACVVL009Y	omitted	Lower CVV Ring, +Z position, STA 544	Y					n/a	n/a	n/a	n/a	position not accessible on FM
PACSTR010X	omitted	STR I/F pad on CVV Lower Bulkhead, -Z/+Y	X					n/a	n/a	n/a	n/a	position not accessible on FM
PACSTR010Y	omitted	STR I/F pad on CVV Lower Bulkhead, -Z/+Y	Y					n/a	n/a	n/a	n/a	position not accessible on FM
PACSTR010Z	omitted	STR I/F pad on CVV Lower Bulkhead, -Z/+Y	Z					n/a	n/a	n/a	n/a	position not accessible on FM
PACVVR0010	accelerometer	CVV -Z/+X Radiator, CoG position	oop (local)	y	y		100 g	Vib	around RT	N	N	
PACVVR0020	accelerometer	CVV -Z/-X Radiator, CoG position	oop (local)	y	y		100 g	Vib	around RT	N	N	
PACVVR0030	accelerometer	CVV +Y/+X Radiator, CoG position	oop (local)	y	y		100 g	Vib	around RT	N	N	
PACVVR0040	accelerometer	CVV +Y/-X Radiator, CoG position	oop (local)	y	y		100 g	Vib	around RT	N	N	
PACVVR0050	accelerometer	CVV -Y/+X Radiator, CoG position	oop (local)	y	y		100 g	Vib	around RT	N	N	
PACVVR0060	accelerometer	CVV -Y/-X Radiator, CoG position	oop (local)	y	y		100 g	Vib	around RT	N	N	
PACCRM003X	omitted	Cryo Cover release mechanism	X					n/a	n/a	n/a	n/a	position not accessible on FM
PACCRM003Y	omitted	Cryo Cover release mechanism	Y					n/a	n/a	n/a	n/a	position not accessible on FM
PACCCV031X	accelerometer	Cryo Cover CVV I/F (Pilot 31 @ AAE test)	X	y	y		30 g	FN/Vib	80K to RT	N	Y	PCB356M131
PACCCV031Y	accelerometer	Cryo Cover CVV I/F (Pilot 31 @ AAE test)	Y	y	y		30 g	FN/Vib	80K to RT	N	Y	"

MP ID	Type	Location	Direction	Usage			Expected max lev.	Time slot	Temp. range	Flight stand.	Vacuum stand.	Remark
				X/Y/Z	sine	A/N						
PACCCV031Z	accelerometer	Cryo Cover CVV I/F (Pilot 31 @ AAE test)	Z	y	y		30 g	FN/Vib	80K to RT	N	Y	"
PACCCV032X	omitted	Cryo Cover CVV I/F (Pilot 32 @ AAE test)	X					n/a	n/a	n/a	n/a	position not accessible on FM
PACCCV032Y	omitted	Cryo Cover CVV I/F (Pilot 32 @ AAE test)	Y					n/a	n/a	n/a	n/a	position not accessible on FM
PACCCV032Z	omitted	Cryo Cover CVV I/F (Pilot 32 @ AAE test)	Z					n/a	n/a	n/a	n/a	position not accessible on FM
PACCYO006X	omitted	Cryo Cover yoke	X					n/a	n/a	n/a	n/a	position not accessible on FM
PACCCJ008Y	omitted	Cryo Cover Johnston coupling	Y					n/a	n/a	n/a	n/a	position not accessible on FM
PACBAF0010	omitted	Cryostat Baffle, +Y, position near I/F	oop (local)					n/a	n/a	n/a	n/a	position not accessible on FM
PACBAF0020	omitted	Cryostat Baffle, -Z, position near I/F	oop (local)					n/a	n/a	n/a	n/a	position not accessible on FM
PACBAF0110	accelerometer	Cryostat Baffle cone area, -Z	oop (local)	y	y		100 g	Vib	around RT	N	N	
PANOZL001X	accelerometer	Nozzle Bracket	X	y	y		50 g	Vib	around RT	N	N	
PANOZL001Y	accelerometer	Nozzle Bracket	Y	y	y		50 g	Vib	around RT	N	N	
PANOZL002X	accelerometer	Nozzle Tube Bracket	X	y	y		50 g	Vib	around RT	N	N	
PANOZL002Y	accelerometer	Nozzle Tube Bracket	Y	y	y		50 g	Vib	around RT	N	N	
PANOZL002Z	accelerometer	Nozzle Tube Bracket	Z	y	y		50 g	Vib	around RT	N	N	
PACVVV1000	omitted	CVV Valve Bracket 1	O					n/a	n/a	n/a	n/a	not needed
PACVVV101X	omitted	CVV Valve Body 1	X					n/a	n/a	n/a	n/a	not needed
PACVVV101T	omitted	CVV Valve Body 1	T					n/a	n/a	n/a	n/a	not needed
PACVVV101O	omitted	CVV Valve Body 1	O					n/a	n/a	n/a	n/a	not needed
PACVVV001X	omitted	CVV Valve Bracket 2	X					n/a	n/a	n/a	n/a	not needed
PACVVV001T	omitted	CVV Valve Bracket 2	T					n/a	n/a	n/a	n/a	not needed
PACVVV001O	omitted	CVV Valve Bracket 2	O					n/a	n/a	n/a	n/a	not needed
PACVVV201X	omitted	CVV Valve Body 2	X					n/a	n/a	n/a	n/a	not needed
PACVVV201T	omitted	CVV Valve Body 2	T					n/a	n/a	n/a	n/a	not needed

MP ID	Type	Location	Direction	Usage			Expected	Time	Temp.	Flight	Vacuum	Remark
				X/Y/Z	sine	A/N						
PACVVV2010	omitted	CVV Valve Body 2	O					n/a	n/a	n/a	n/a	not needed
PACVVV3000	omitted	CVV Valve Bracket 3	O					n/a	n/a	n/a	n/a	not needed
PACVVV301X	omitted	CVV Valve Body 3	X					n/a	n/a	n/a	n/a	not needed
PACVVV301T	omitted	CVV Valve Body 3	T					n/a	n/a	n/a	n/a	not needed
PACVVV301O	omitted	CVV Valve Body 3	O					n/a	n/a	n/a	n/a	not needed
PACVVV400X	accelerometer	CVV Valve Bracket 4	X	y	y		50 g	Vib	around RT	N	N	
PACVVV400T	accelerometer	CVV Valve Bracket 4	T	y	y		50 g	Vib	around RT	N	N	
PACVVV400O	accelerometer	CVV Valve Bracket 4	O	y	y		50 g	Vib	around RT	N	N	
PACVVV401X	accelerometer	CVV Valve Body 4	X	y	y		50 g	Vib	around RT	N	N	
PACVVV401T	accelerometer	CVV Valve Body 4	T	y	y		50 g	Vib	around RT	N	N	
PACVVV401O	accelerometer	CVV Valve Body 4	O	y	y		50 g	Vib	around RT	N	N	
PAWAVG001Y	accelerometer	Waveguide	Y	y	y		200 g	Vib	around RT	N	N	
PAWAVG001Z	accelerometer	Waveguide	Z	y	y		200 g	Vib	around RT	N	N	
PAWAVG002X	accelerometer	Waveguide Bracket	X	y	y		100 g	Vib	around RT	N	N	
PAWAVG002Y	accelerometer	Waveguide Bracket	Y	y	y		100 g	Vib	around RT	N	N	
PAWAVG002Z	accelerometer	Waveguide Bracket	Z	y	y		100 g	Vib	around RT	N	N	
SVM Thermal Shield												
PASVTS001X	accelerometer	SVM Thermal Shield, over strut support	X	y	y		100 g	Vib	around RT	N	N	LP5X from unit test
PASVTS001Y	accelerometer	SVM Thermal Shield, over strut support	Y	y	y		100 g	Vib	around RT	N	N	
PASVTS001Z	accelerometer	SVM Thermal Shield, over strut support	Z	y	y		100 g	Vib	around RT	N	N	
PASVTS002X	accelerometer	SVM Thermal Shield, -Y side	X	y	y		100 g	Vib	around RT	N	N	LP2X from unit test
PASVTS002Y	accelerometer	SVM Thermal Shield, -Y side	Y	y	y		100 g	Vib	around RT	N	N	
PASVTS002Z	accelerometer	SVM Thermal Shield, -Y side	Z	y	y		100 g	Vib	around RT	N	N	
PASVTS003X	accelerometer	SVM Thermal Shield, +Y side	X	y	y		100 g	Vib	around RT	N	N	between RP4X, RP5X
PASVTS003Y	accelerometer	SVM Thermal Shield, +Y side	Y	y	y		100 g	Vib	around RT	N	N	
PASVTS003Z	accelerometer	SVM Thermal Shield, +Y side	Z	y	y		100 g	Vib	around RT	N	N	



Instrumentation Plan

Herschel

MP ID	Type	Location	Direction	Usage			Expected	Time	Temp.	Flight	Vacuum	Remark
			X/Y/Z	sine	A/N	μ-vib	max lev.	slot	range	stand.	stand.	
Telescope: Defined by ASEF in a separate Plan; ref. to HER.NT.1074.T.ASTR and H-P-2-ASP-SP-1337, Issue 3												

Measurement points statistics

Installed sensors (not all will be used):

Total EPLM overall:	231
Total accelerometers:	152
Total strain gauge: (incl. 13 SG contingency)	79

EPLM Post test access (Channels):

Cryo-accelerometers	20	Cryostat internal; no access
Flight accelerometers & cable	13*	No access; to remain for flight
Non-flight, vacuum suitable	51**	LSS suitable; removed after test
Non-flight, non vacuum	68***	Not for LSS; removed after test
Straingauge	79	Cable to be removed

*) Flight: 5 x Endevco 2220 on HSS and 4 x PCB356M131 on HSS struts

**) Vacuum: 32 x Endevco 2220 and 8 x 2 PCB356M131 on HSS struts and 1 x 3 PCB356M131 on Cryo Cover

***) Accel. PANOZL003 XYZ added

Channels foreseen per test:

	Sine	A/N	μ -vibe
Total EPLM:	231	231	6
Total acc:	152	152	6
Total s/g:	79	79	0
SVM ACC.	118	123	15
TEL ACC:	23*	23	0
TEL s/g tbc	12	0	0
Total (EPLM + SVM+TEL)			
Acc. channels total	293	298	21
s/g channels	91	79	21
Total ACC+s/g FM:	384	377	21

*) use of telescope bipod strain gauge is tbc

5 Annex A: Position of Measurement Points

5.1 Internal Cryostat Accelerometers

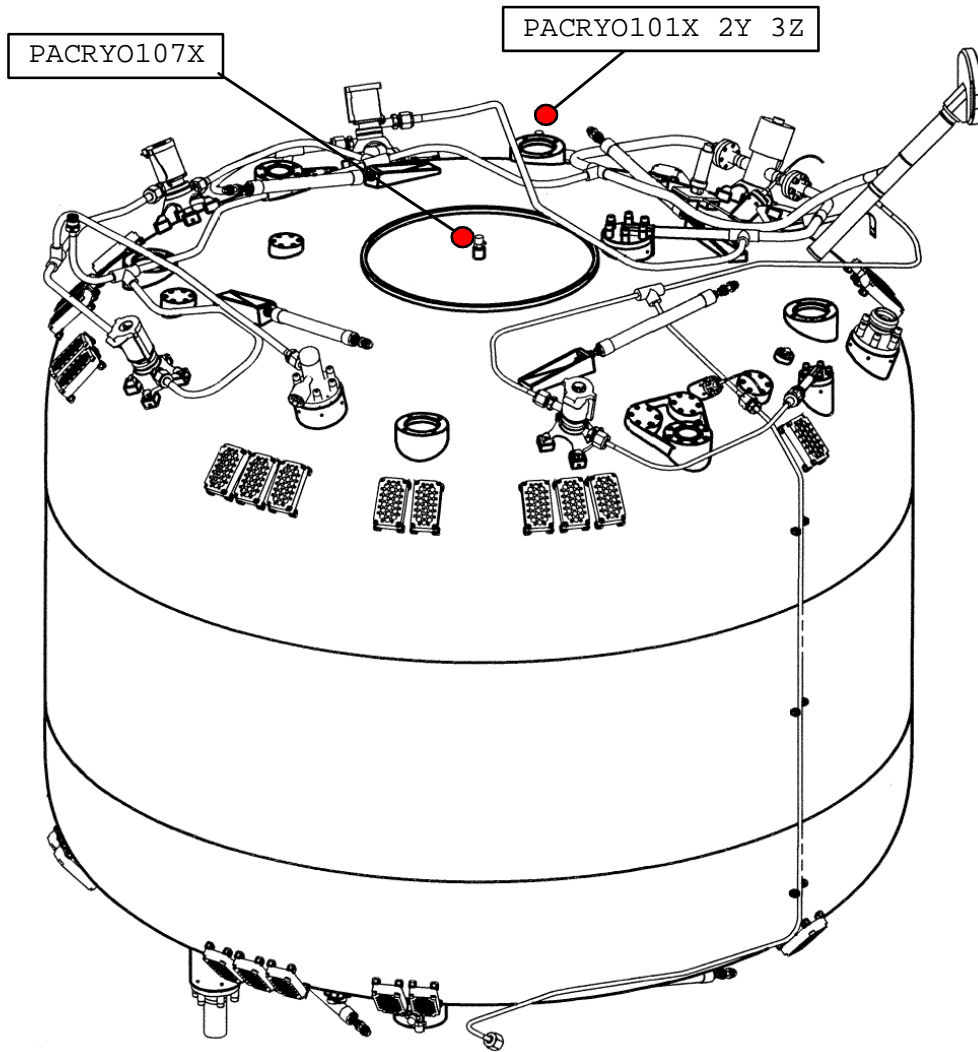


Figure 5-1: HTT accelerometers

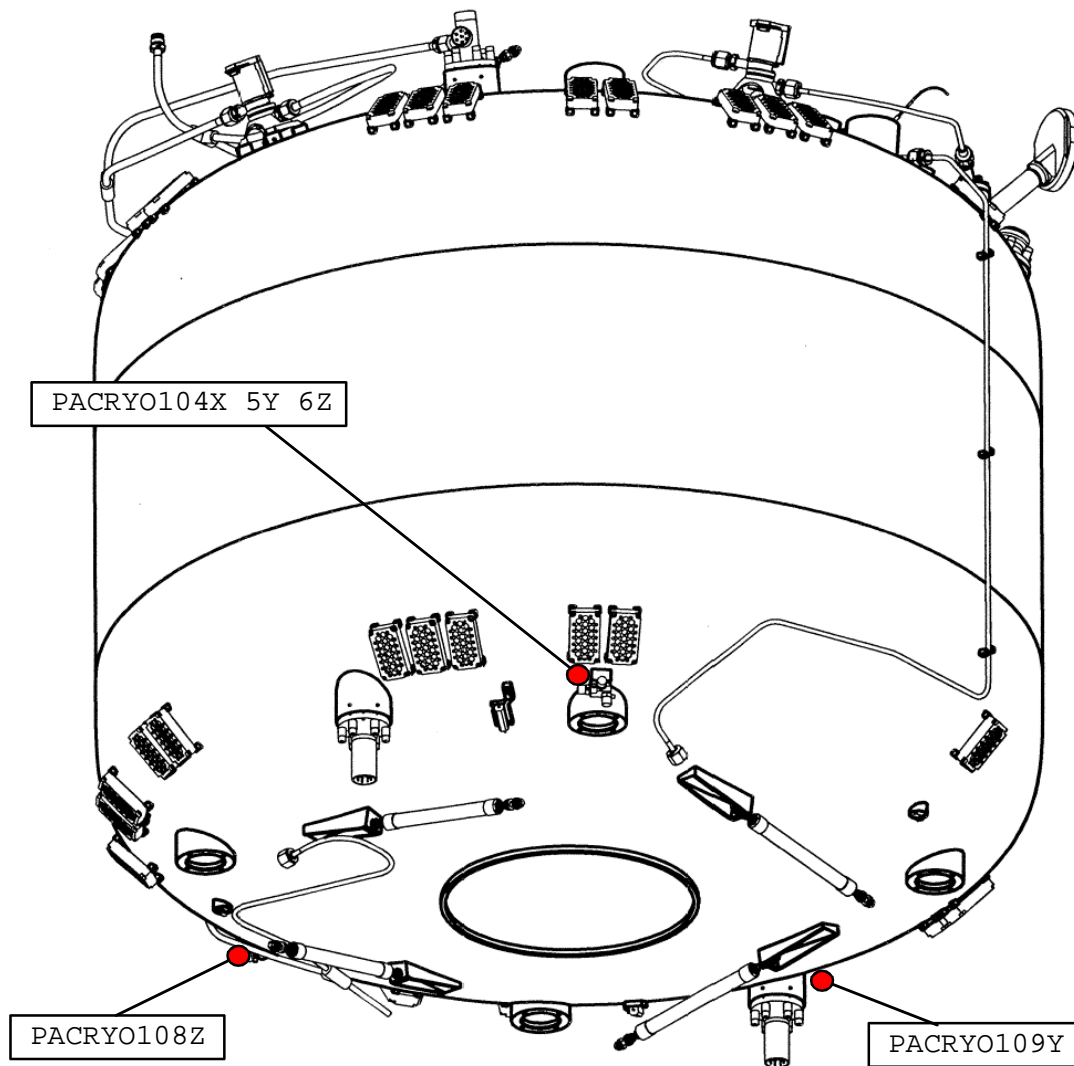


Figure 5-2: HTT accelerometers (cont)

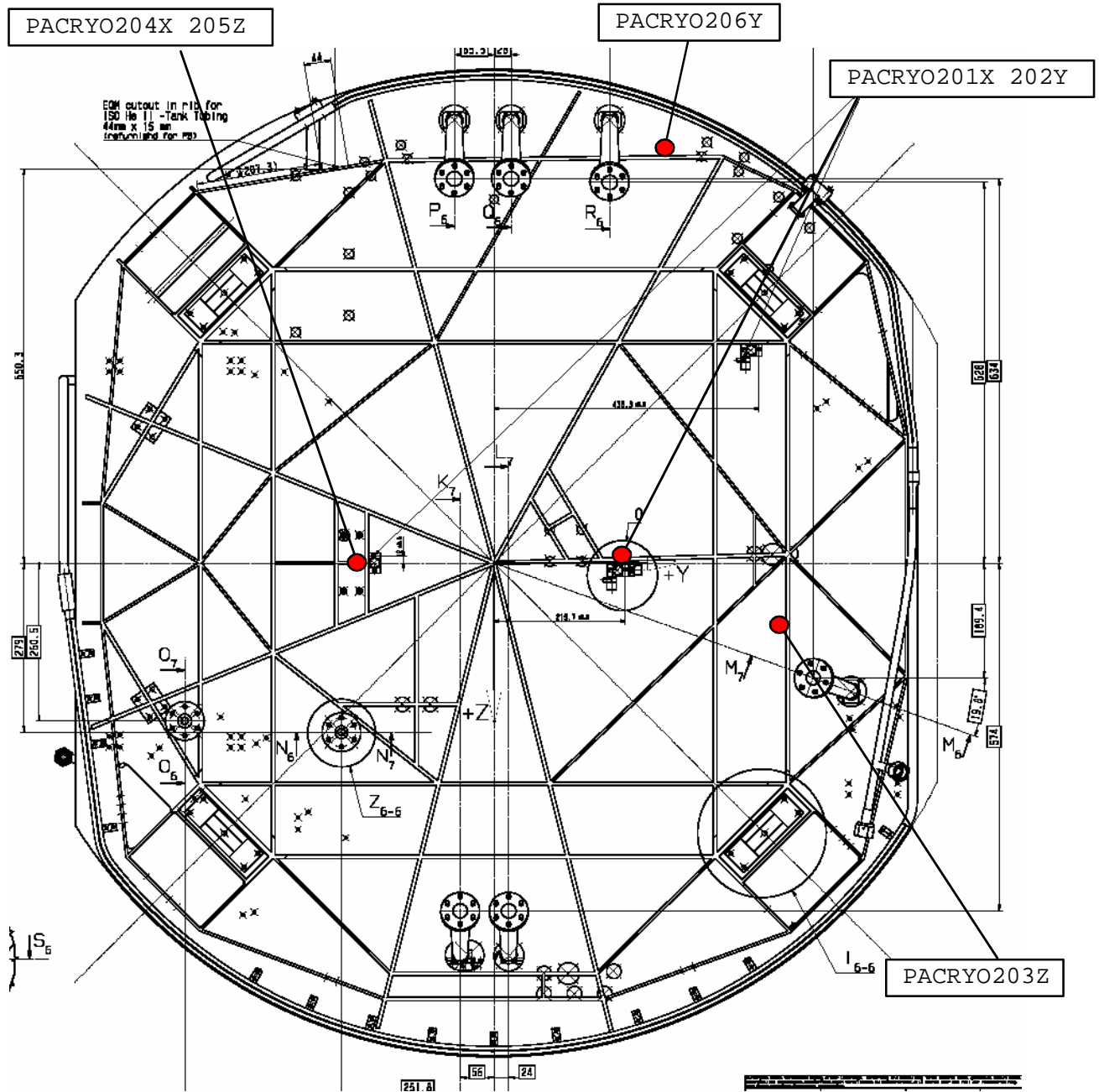


Figure 5-3: OBA Optical Bench Plate shown from below

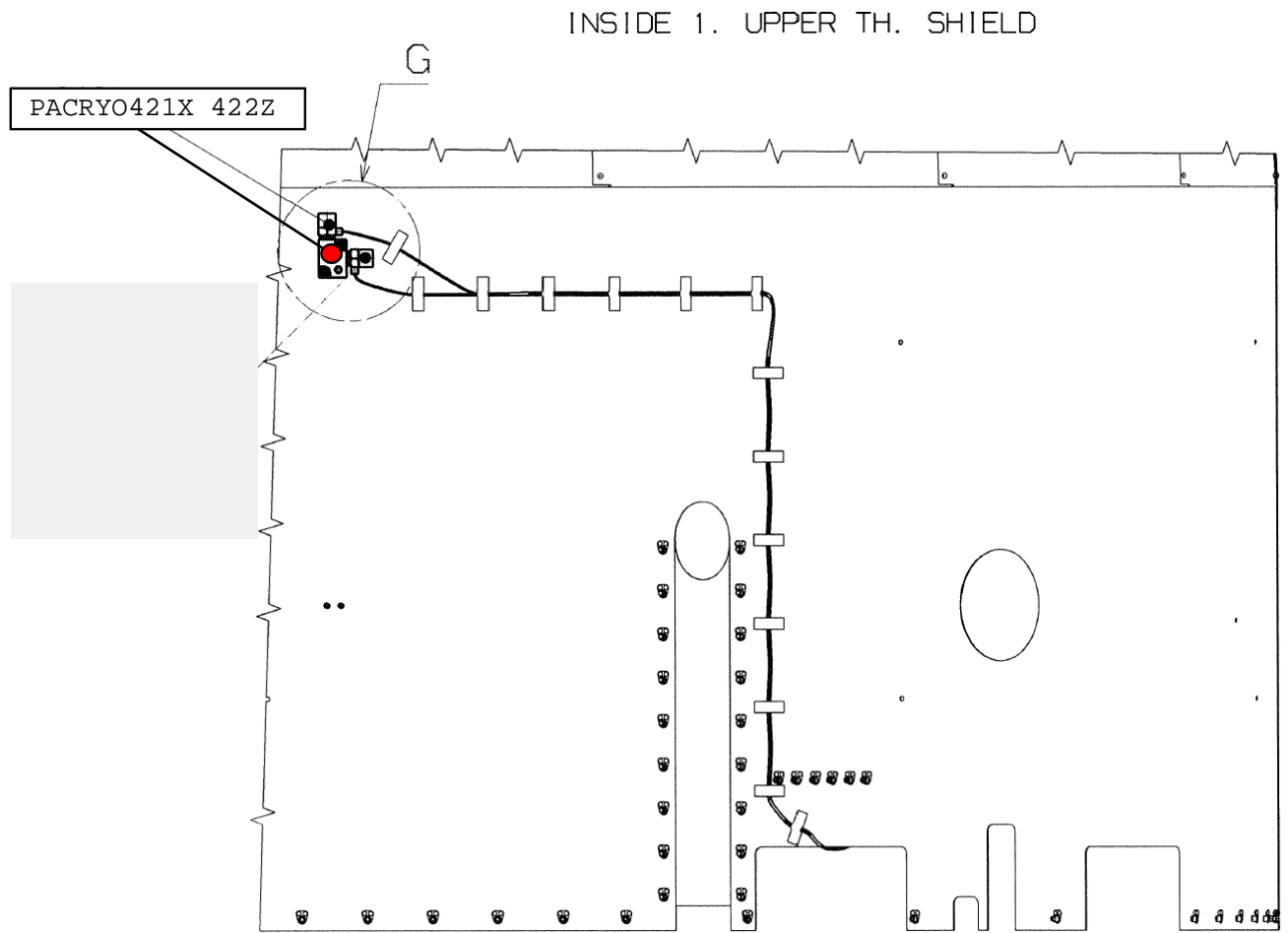


Figure 5-4: TS1 Upper Bulkhead

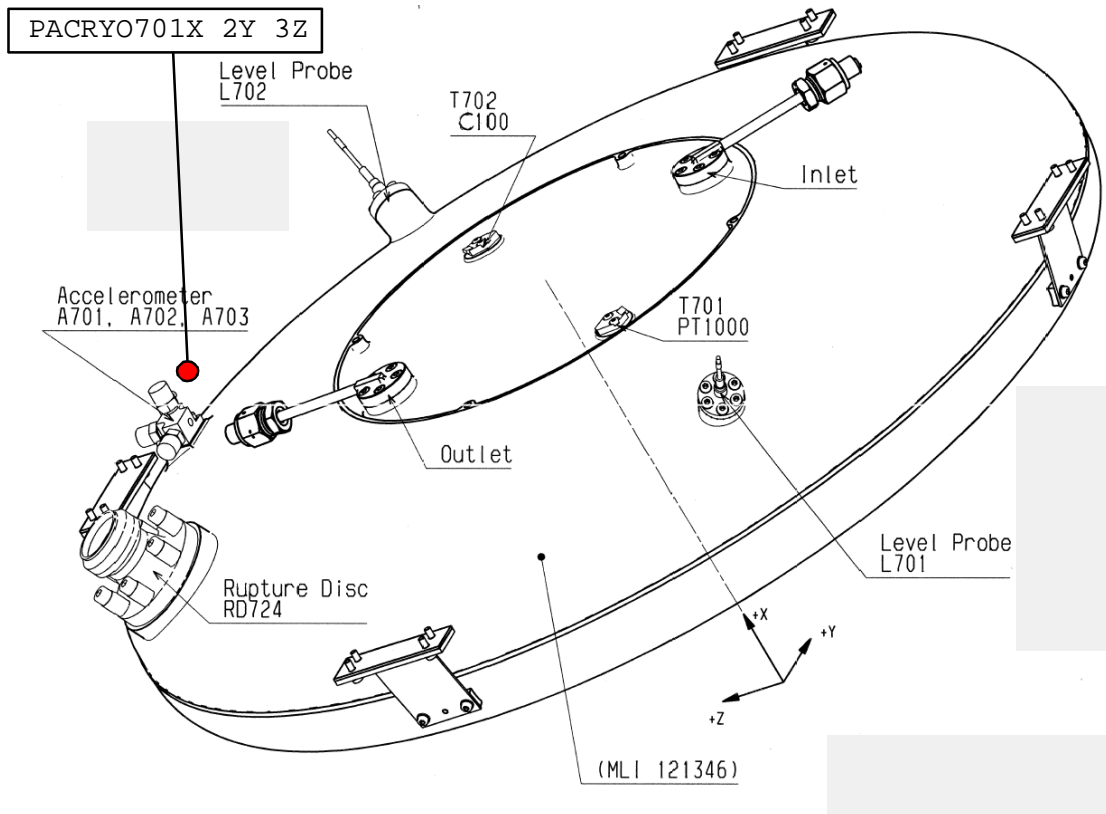


Figure 5-5: HOT accelerometers

5.2 HSS instrumentation

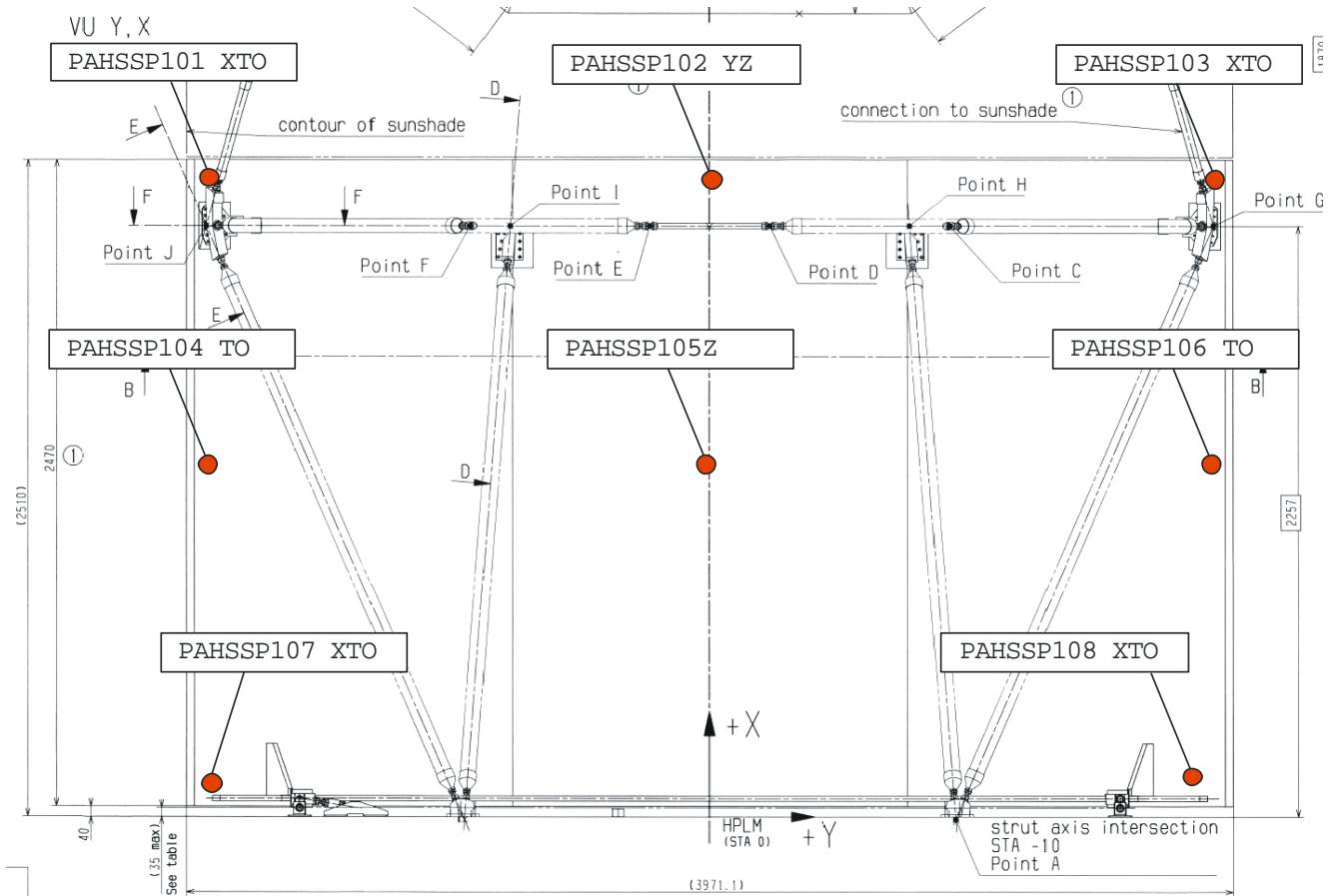


Figure 5-6: Solar Array Panels

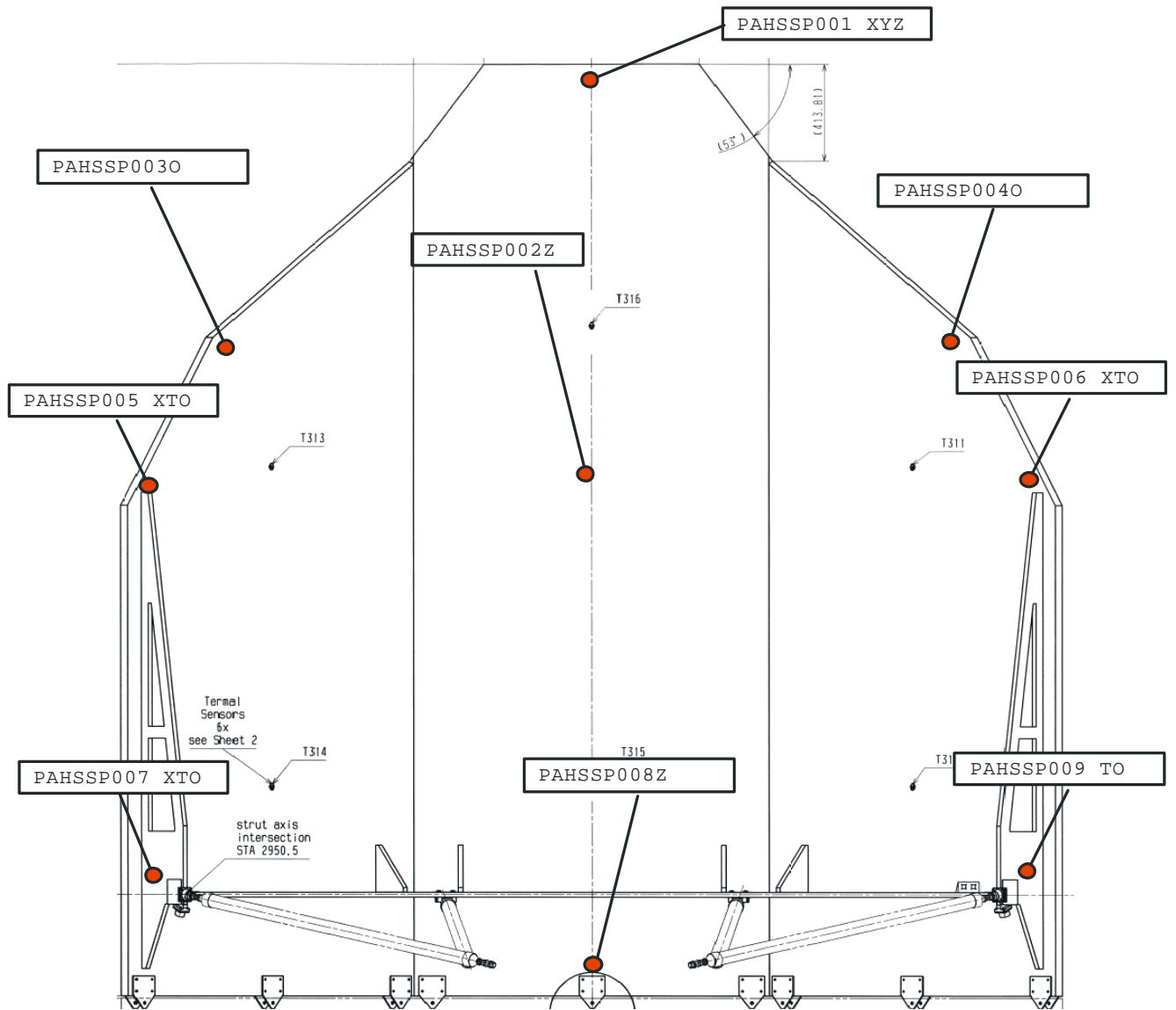


Figure 5-7: Sunshade Panels

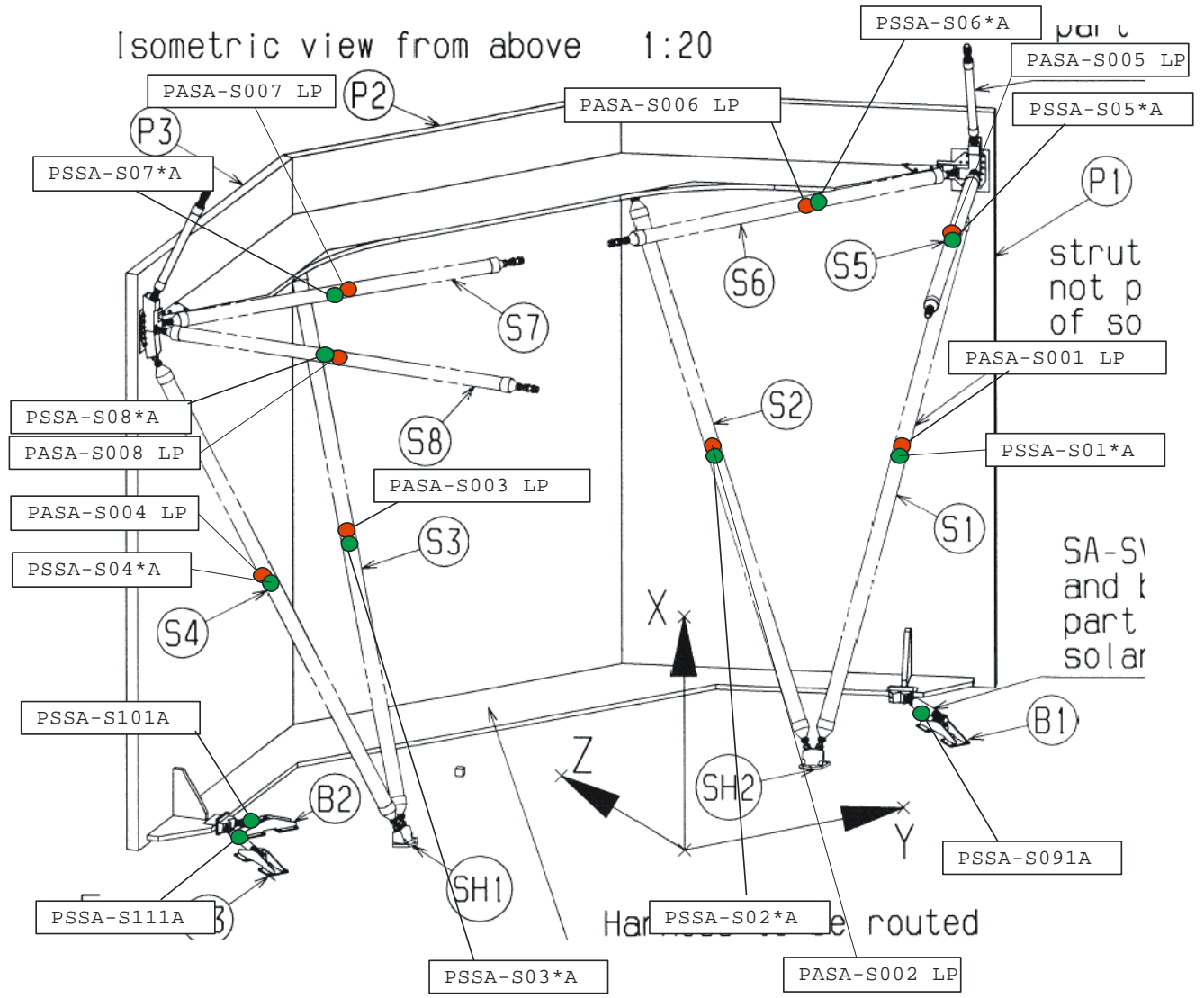


Figure 5-8: Solar Array Struts

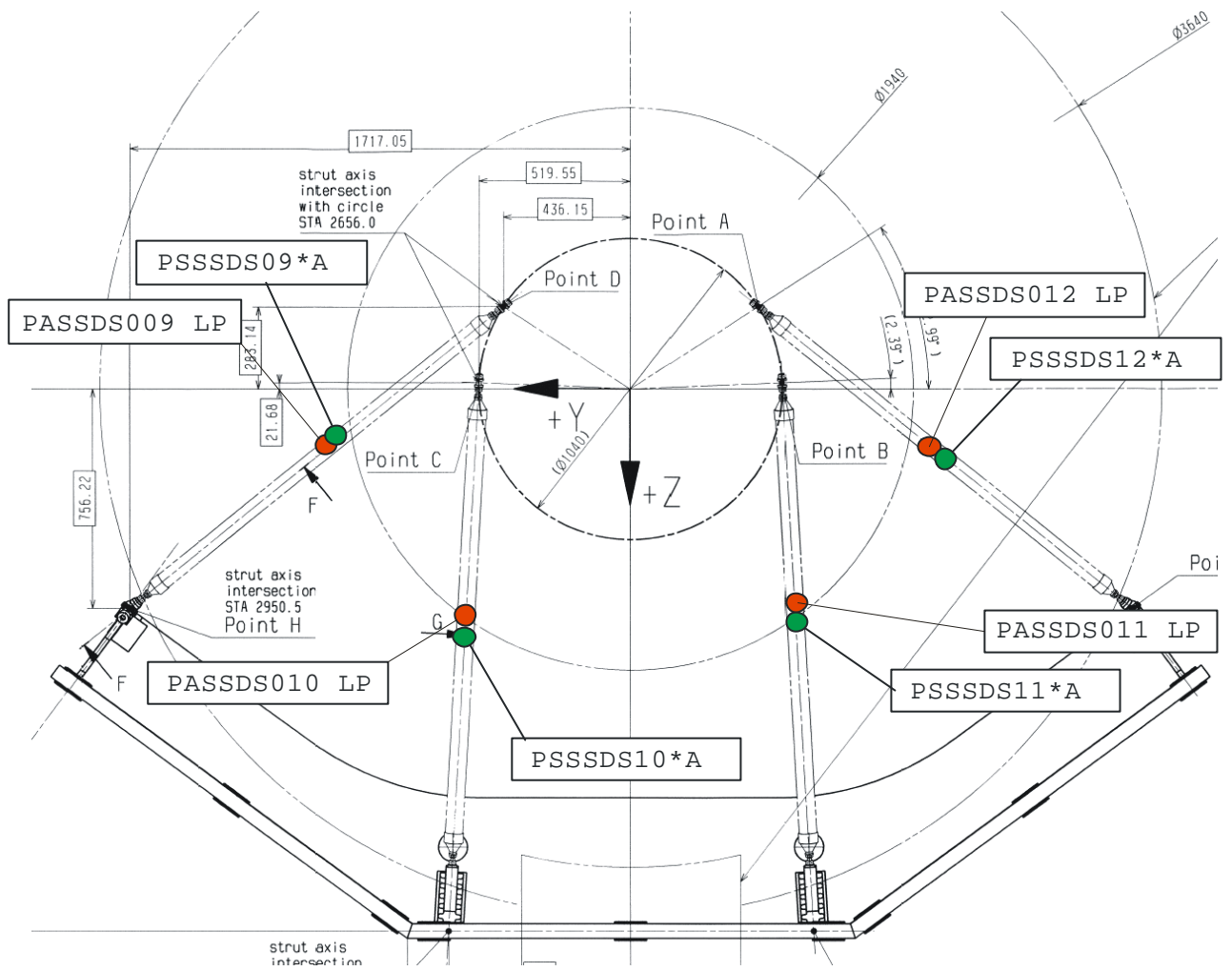
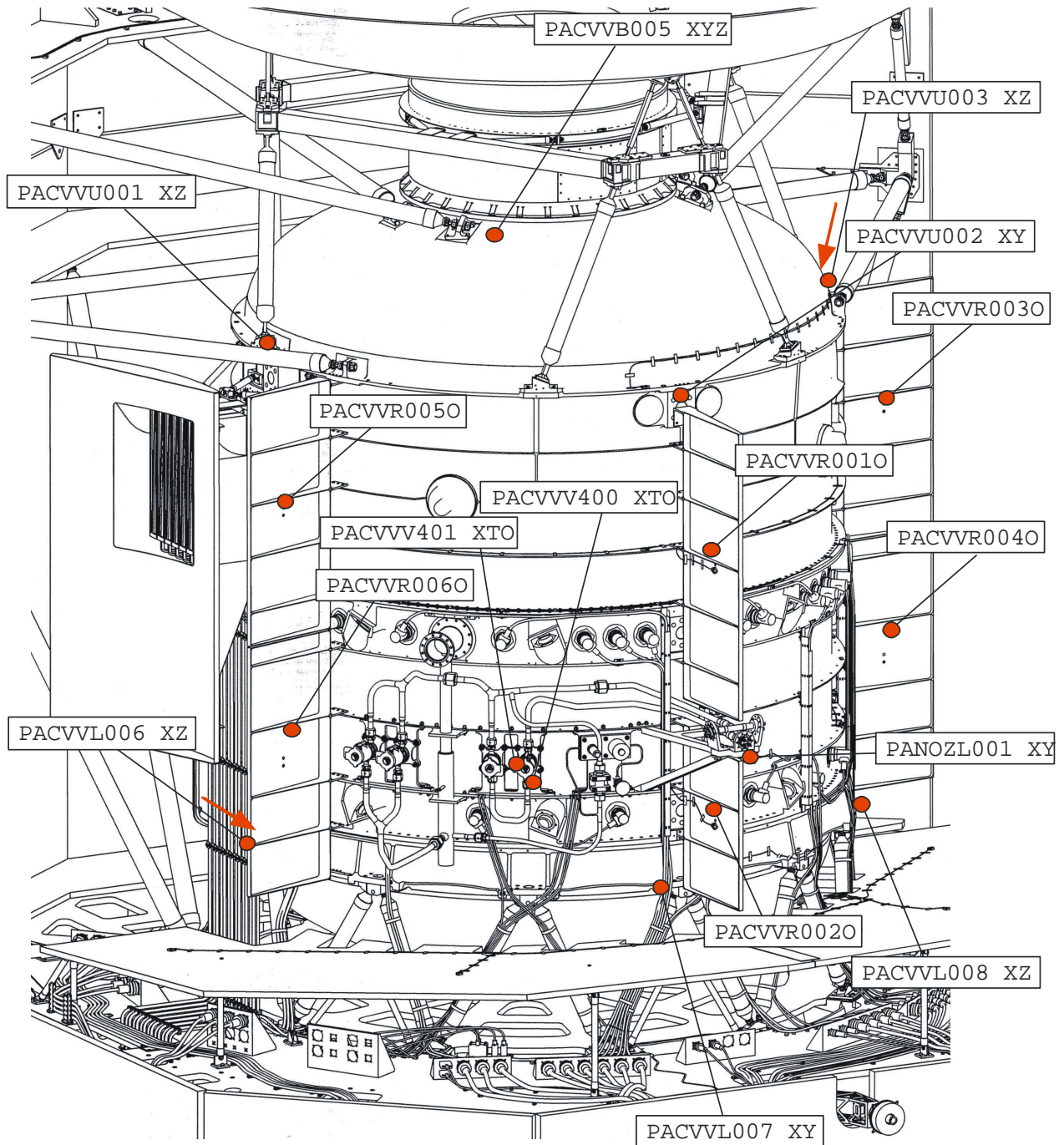


Figure 5-9: Sunshade Struts

5.3 External EPLM instrumentation



- PACVVL009 XY : accelerometers deleted due to difficult MLI access
- PACVVU004 XY
- PACVVL006 XZ : similar to PACVVL007, near $Z_{\text{PLM}} = 0$
- PACVVL008 XZ

Figure 5-10a: CVV external accelerometers

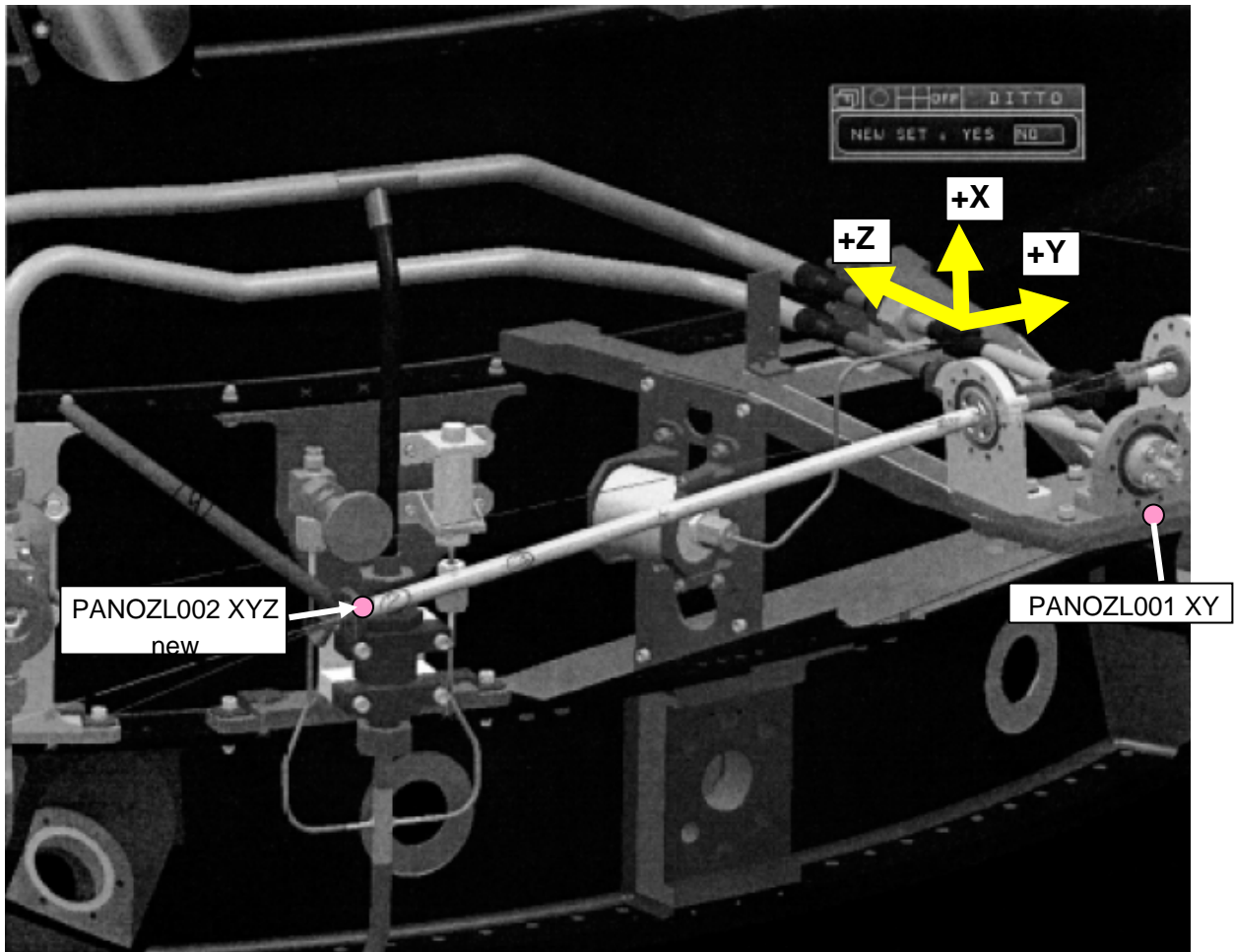


Figure 5-10b: CVV Nozzle Tube bracket accelerometers PANOZL002xyz

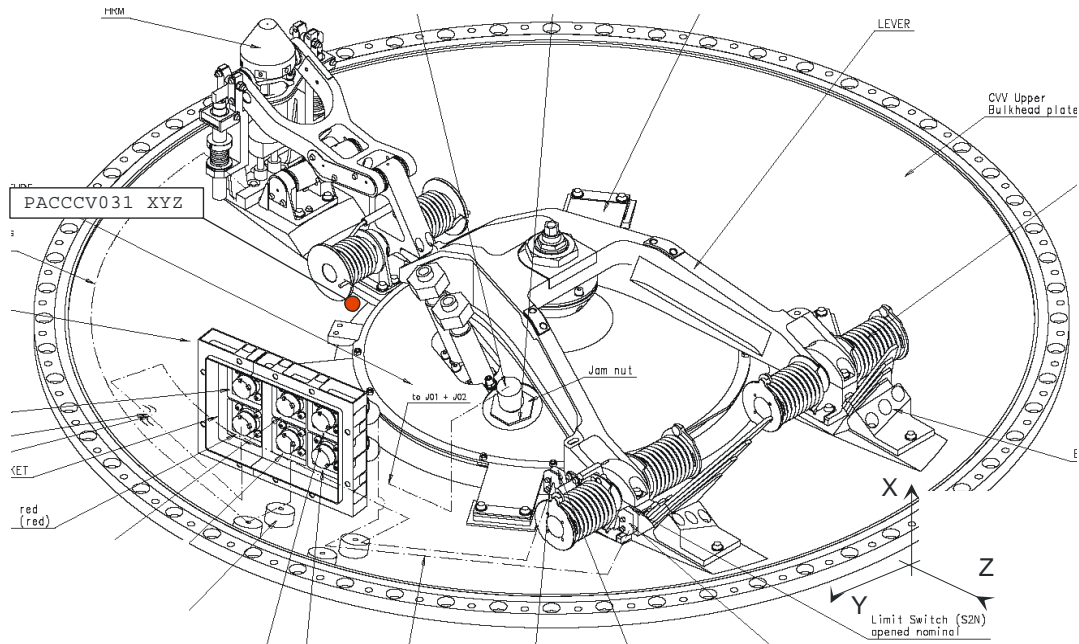
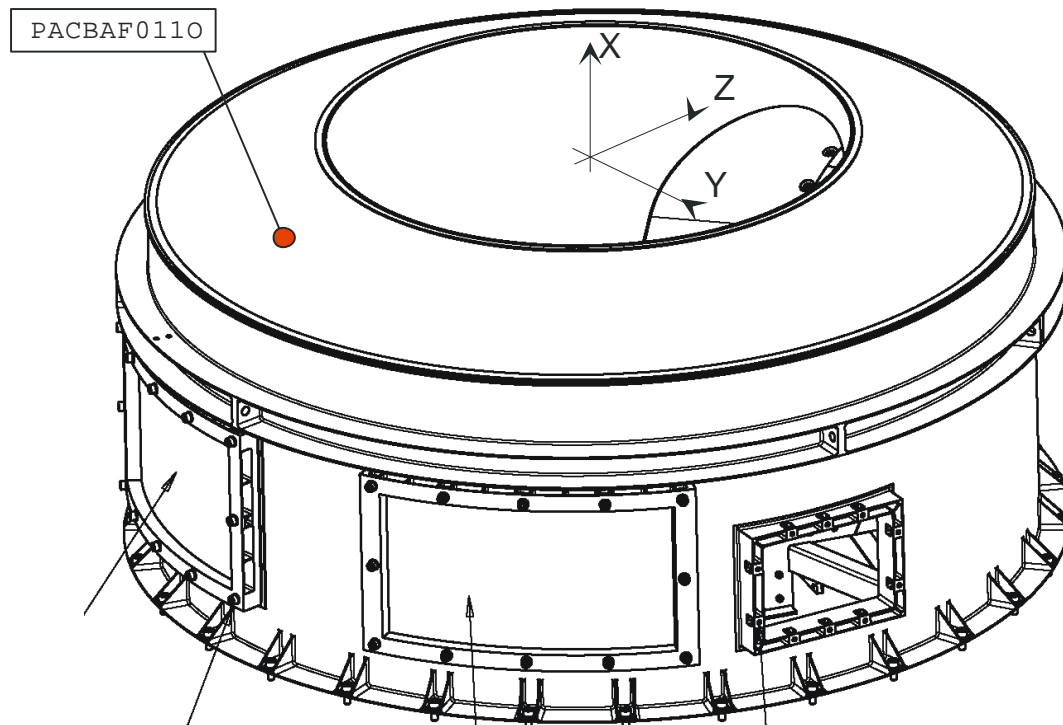


Figure 5-11: Cryostat Cover



For I/F see also: PACVVB005 XYZ

Figure 5-12: Cryostat Baffle

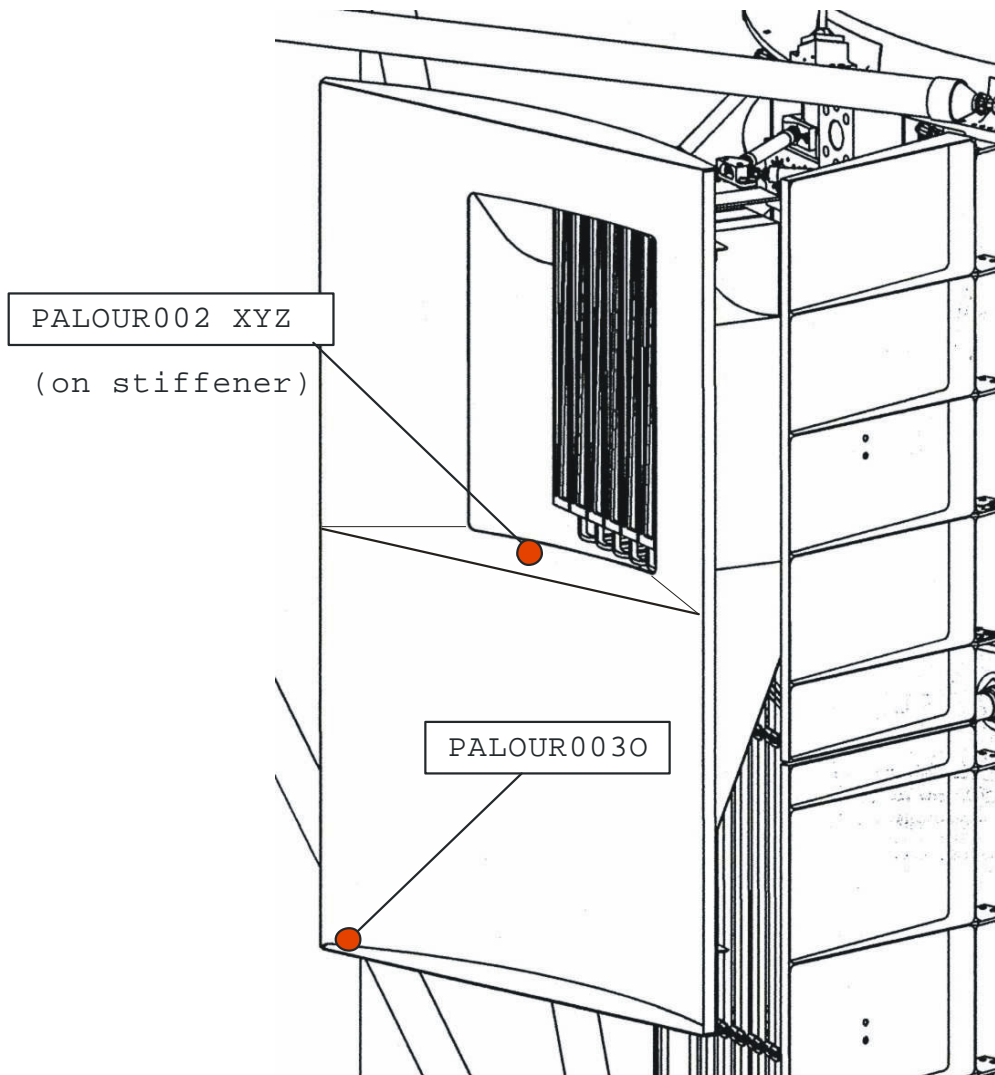


Figure 5-13: LOU Radiator

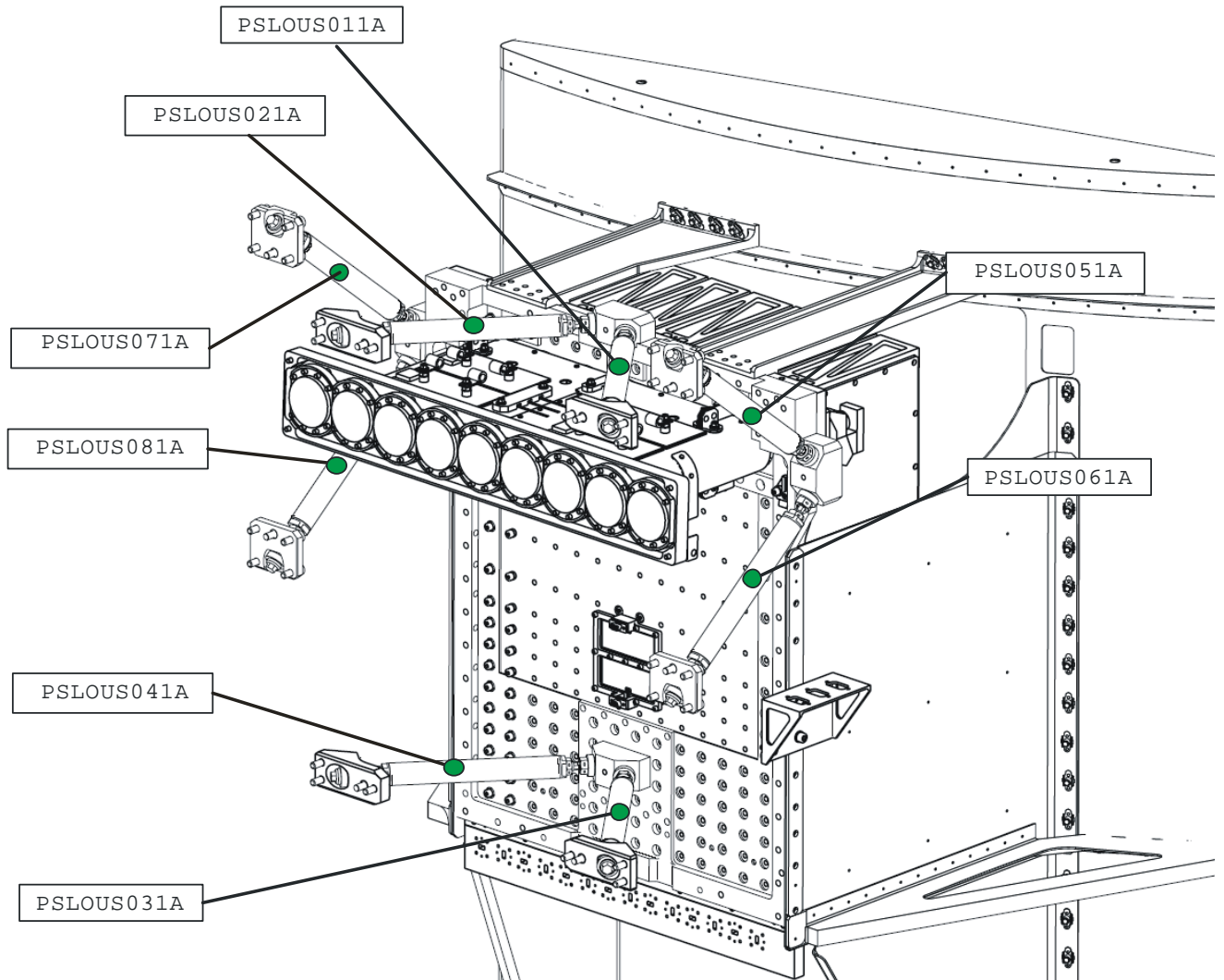


Figure 5-14: LOU Support Structure (shown with External LOU Baffle)

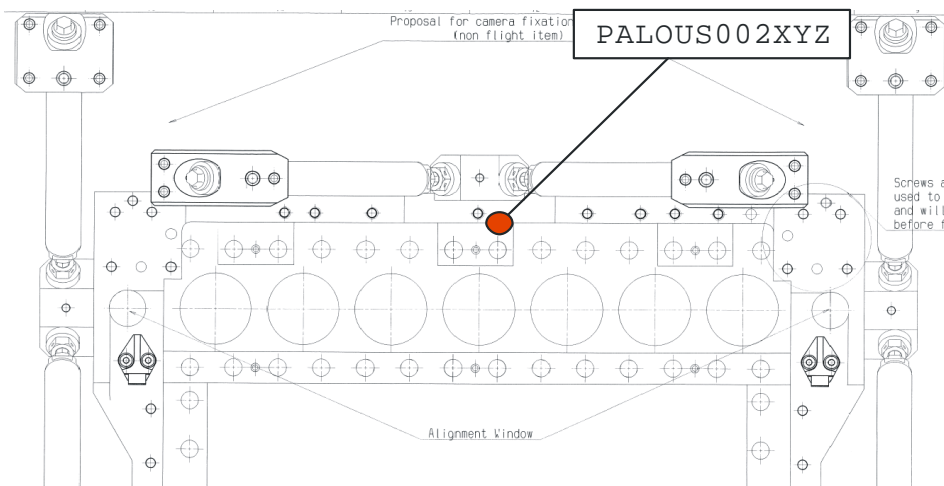


Figure 5-15: LOU Baffle I/F (baffle not shown)

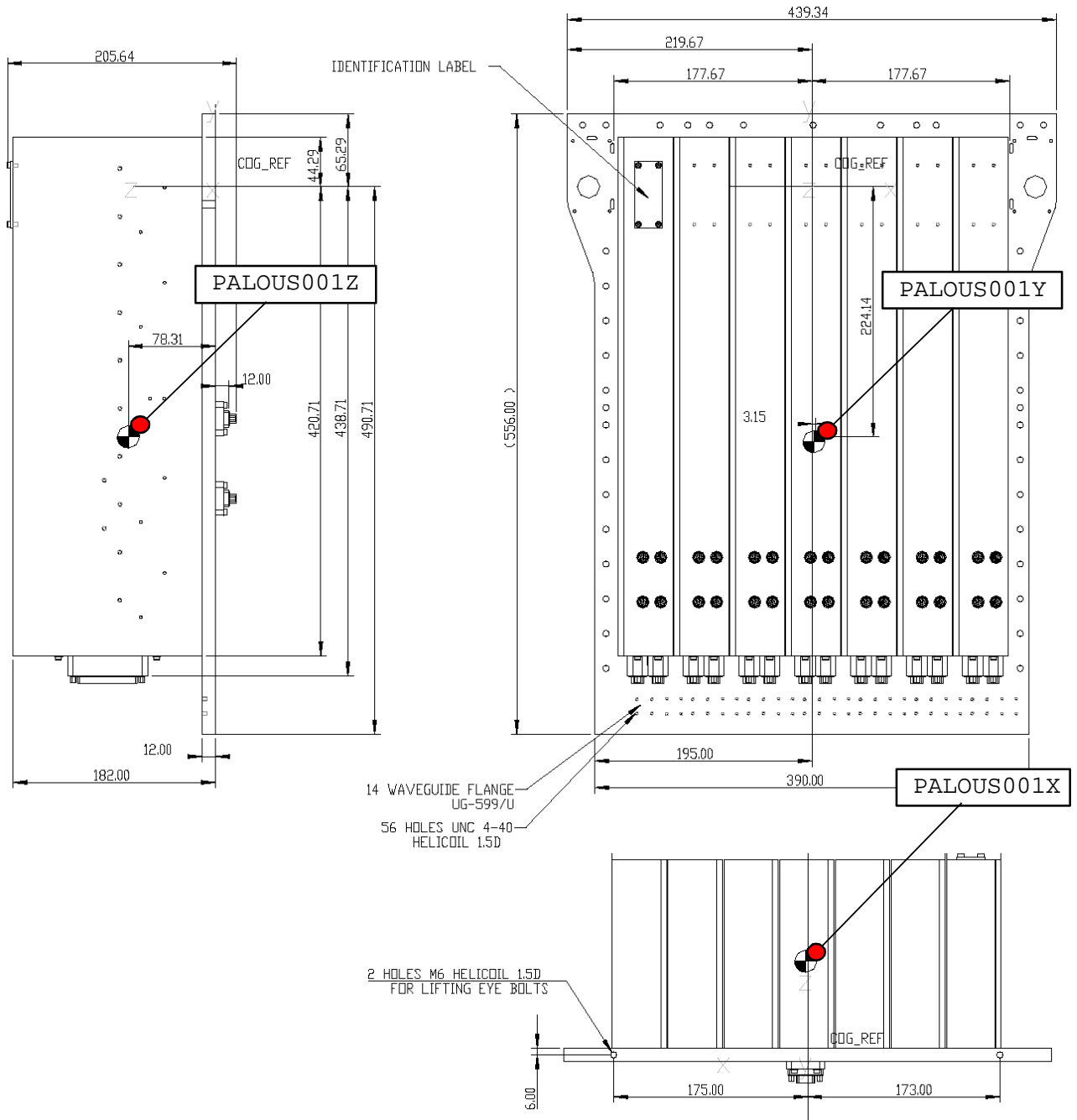


Figure 5-16: LOU sensors (shown here on MTD)

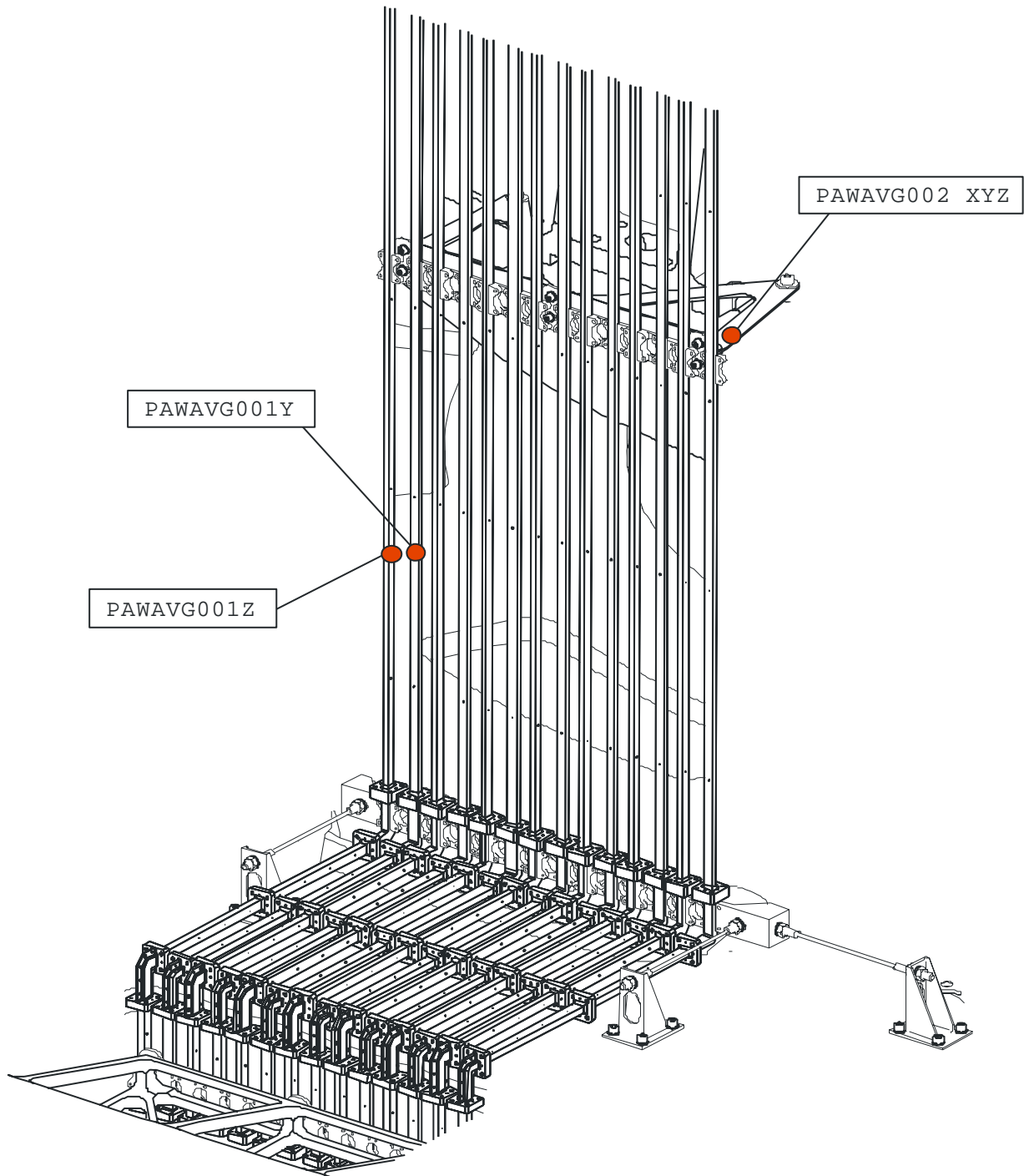


Figure 5-17: LOU Waveguides

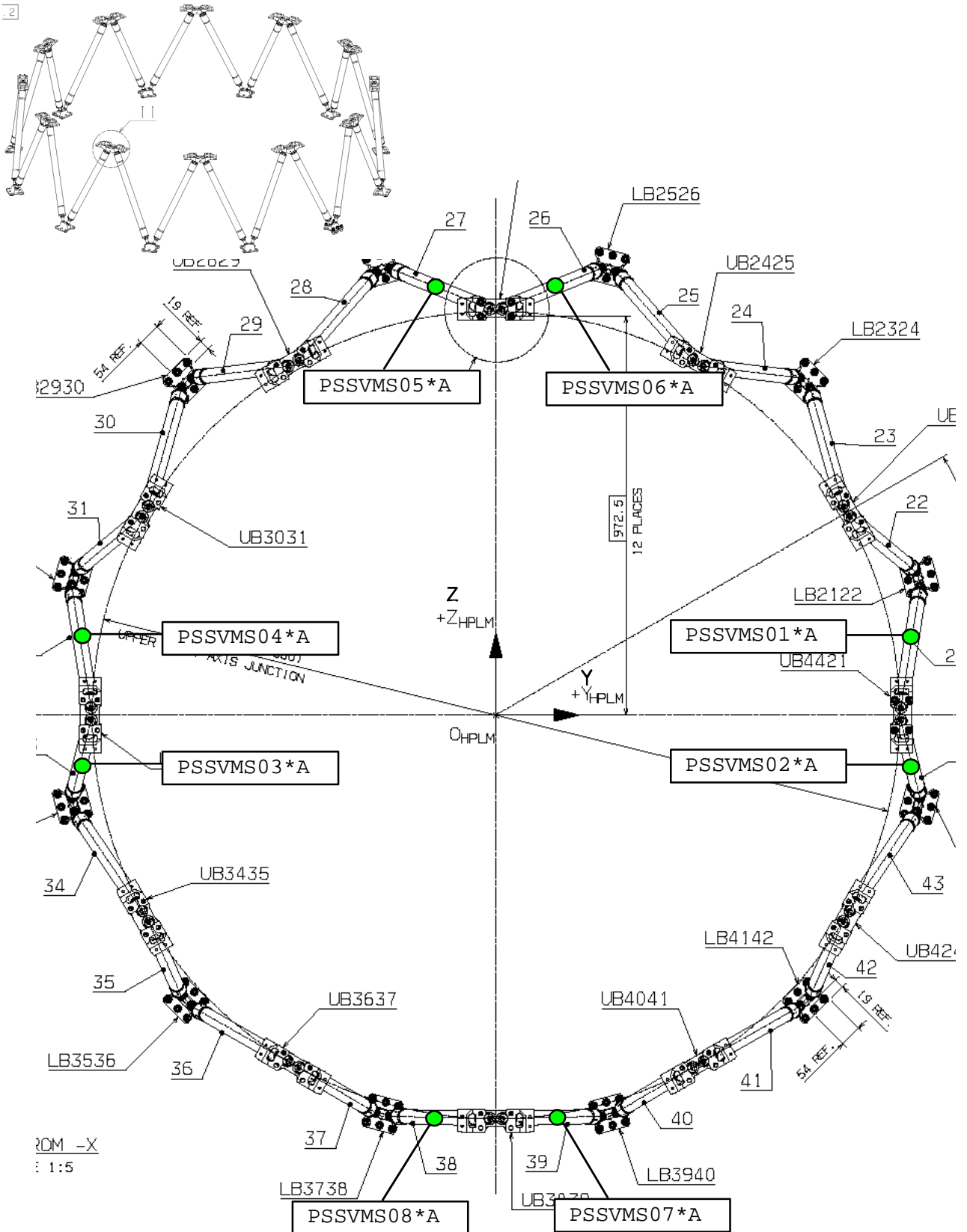


Figure 5-18: SVM/PLM Struts

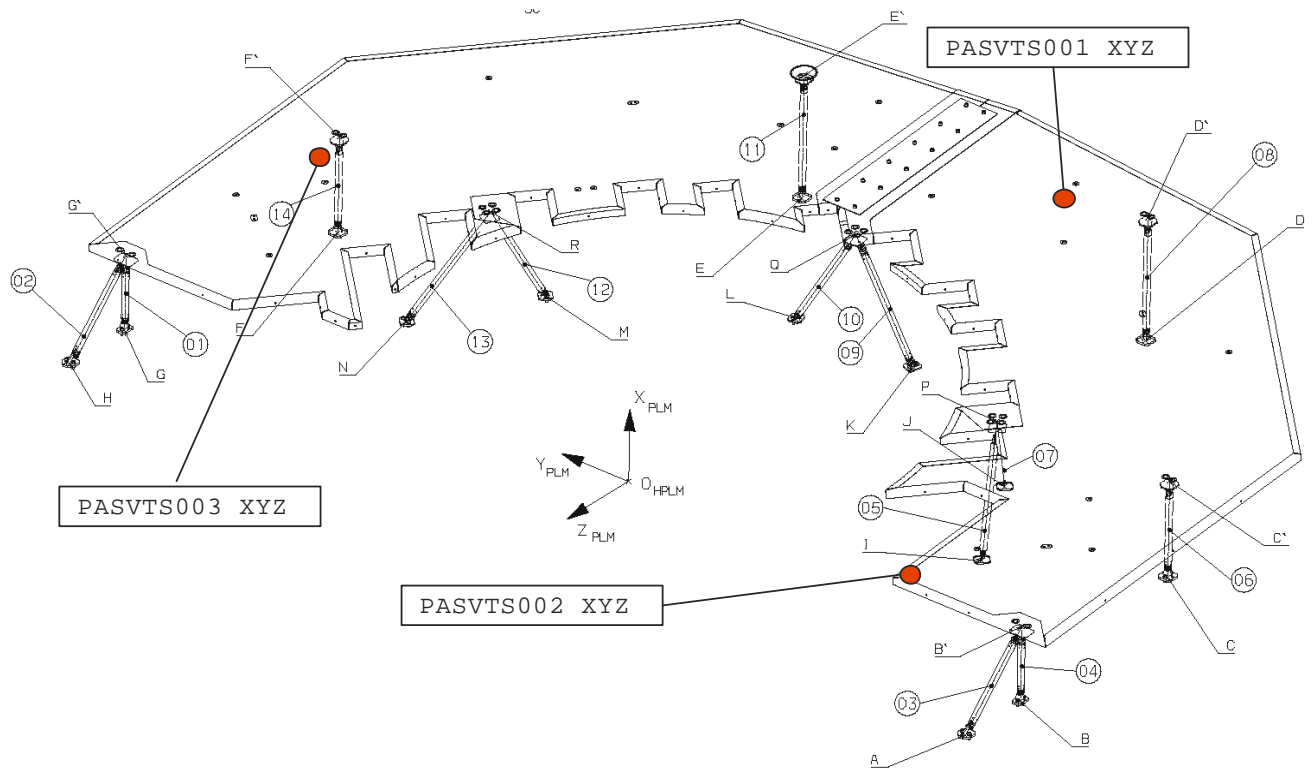


Figure 5-19: SVM Thermal Shield

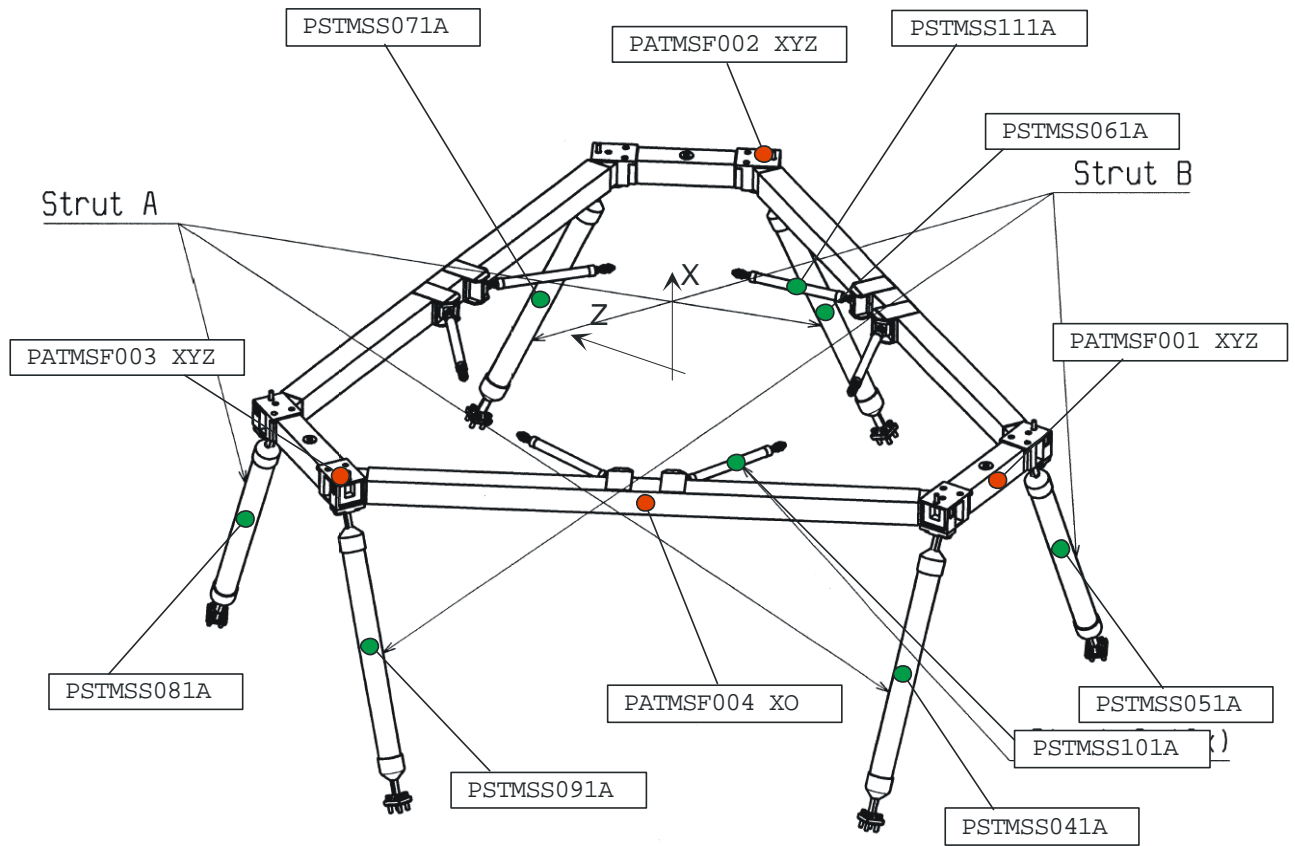


Figure 5-20: Telescope Mounting Structure, TMS

7 Annex C: Test harness routing

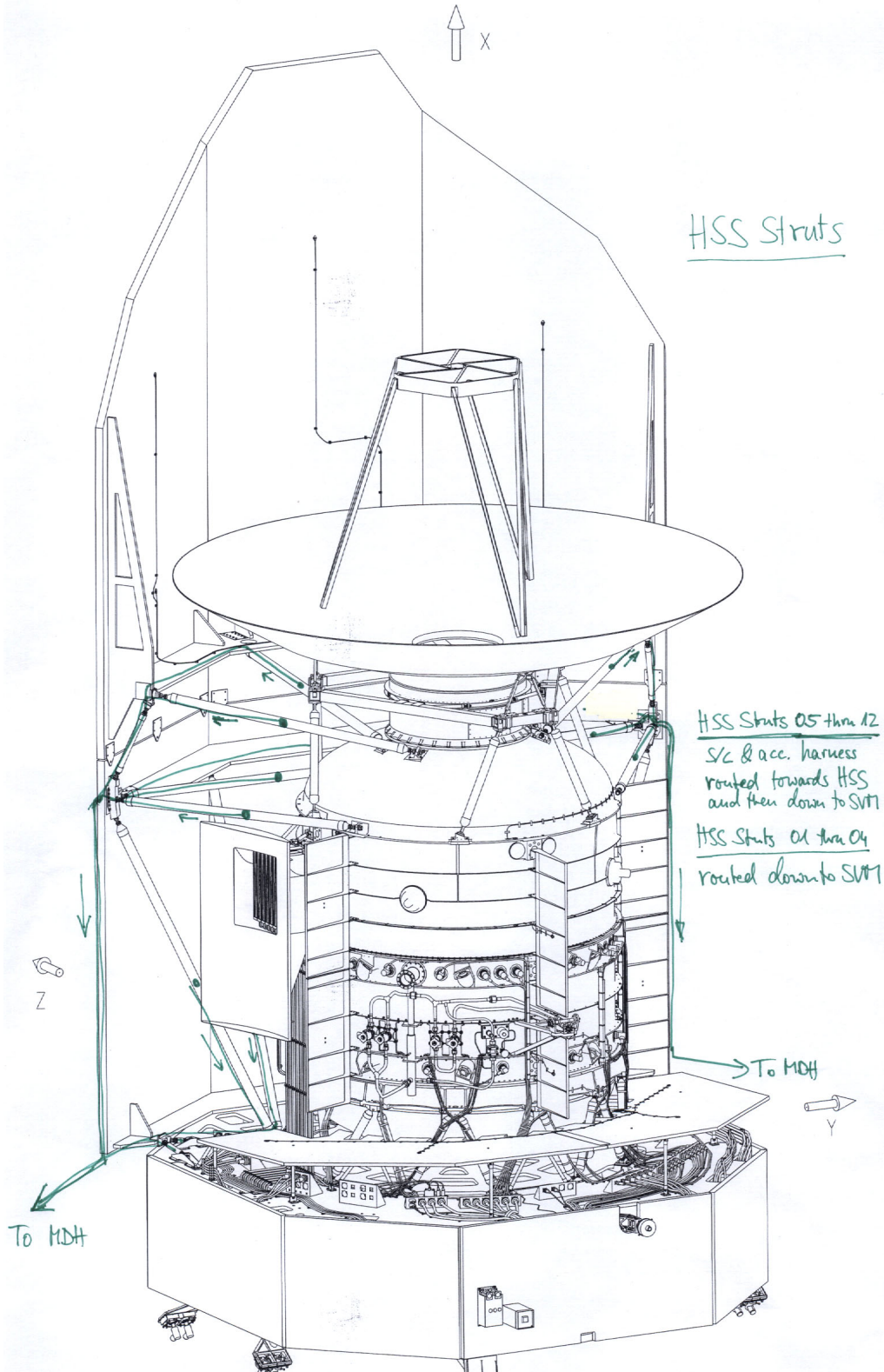


Figure 7-1: Test harness routing HSS Struts

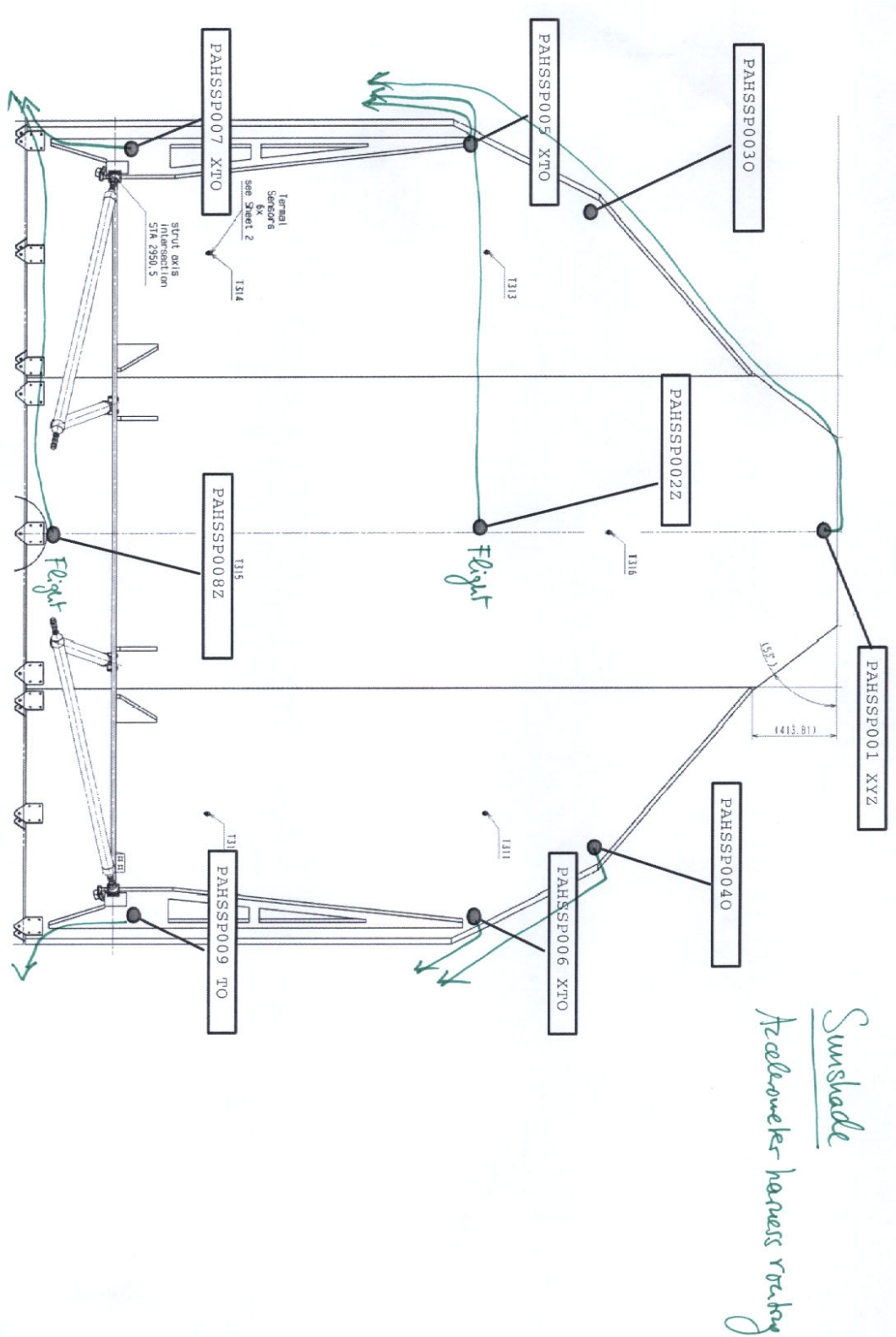


Figure 7-2: Test harness routing Sunshade

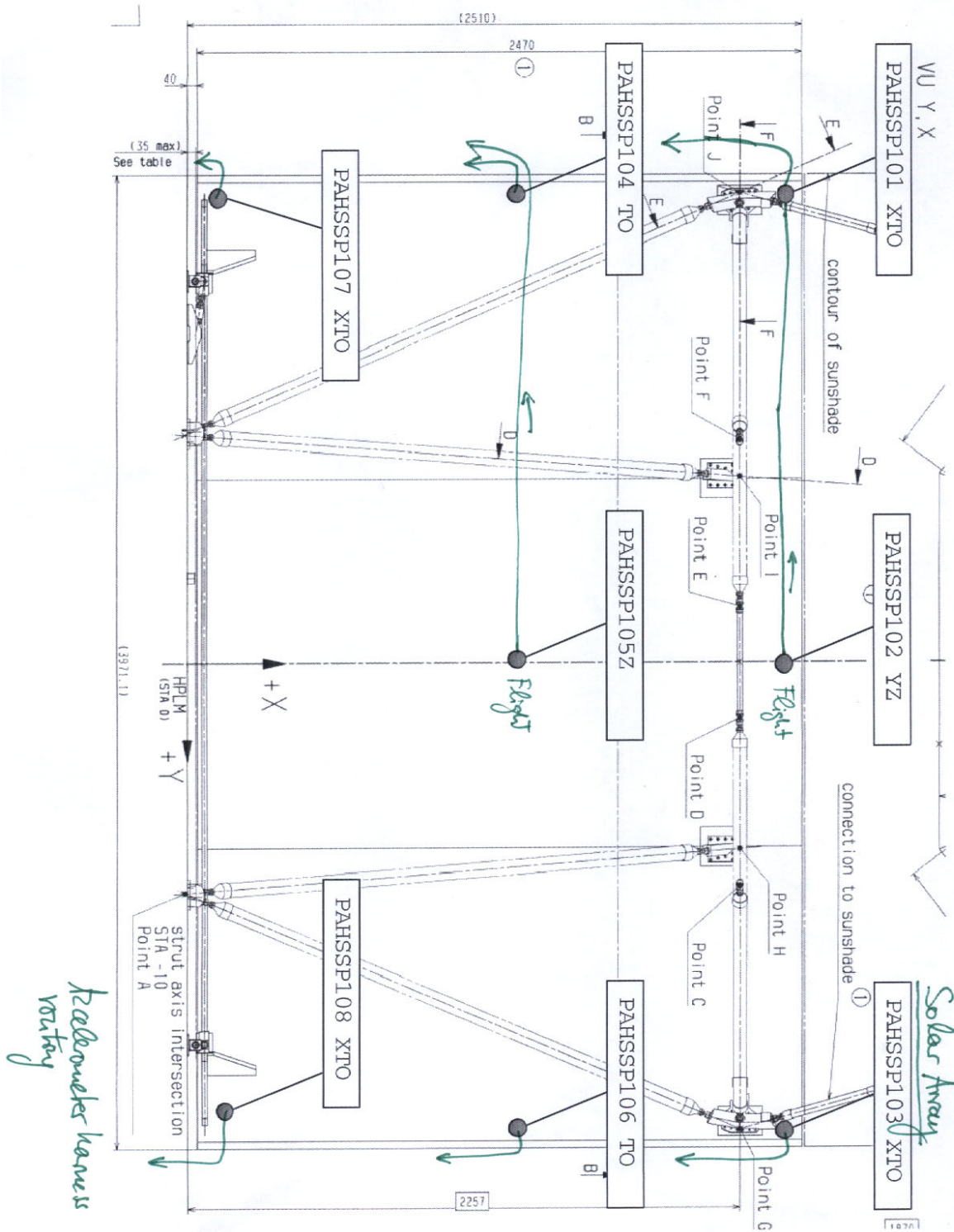


Figure 7-3: Test harness routing Solar Array

END OF DOCUMENT

	Name	Dep./Comp.		Name	Dep./Comp.
	Alberti von Mathias Dr.	ASG23		Schmidt Thomas	AED15
	Baldock Richard	FAE12	X	Schweickert Gunn	ASG23
X	Barlage Bernhard	AED13	X	Sonn Nico	ASG51
X	Bayer Thomas	ASA42		Steininger Eric	AED32
	Brune Holger	ASA45	X	Stritter Rene	AED11
	Edelhoff Dirk	AED2		Suess Rudi	OTN/ASA44
	Fehringer Alexander	ASG13		Theunissen Martijn	DSSA
X	Fricke Wolfgang Dr.	AED 65		Vascotto Riccardo	HE Space
	Geiger Hermann	ASA42		Wagner Klaus	ASG23
	Grasl Andreas	OTN/ASA44	X	Wietbrock Walter	AET12
	Grasshoff Brigitte	AET12	X	Wöhler Hans	ASG23
	Hamer Simon	Terma		Wössner Ulrich	ASE252
	Hanka, Erhard	FI552		Zumstein Armin	ASQ42
	Hendrikse Jeffrey	HE Space			
X	Hendry David	Terma			
	Hengstler Reinhold	ASA42			
	Hinger Jürgen	ASG23			
X	Hohn Rüdiger	AED65			
	Hölzle Edgar Dr.	AED32			
	Hopfgarten Michael	AED32			
X	Huber Johann	ASA42			
X	Hund Walter	ASE252			
X	Idler Siegmund	AED312			
	Ivány von András	FAE12			
	Jahn Gerd Dr.	ASG23			
	Kalde Clemens	ASM2	X	ESA/ESTEC	ESA
X	Kettner Bernhard	AET42	X	Thales Alenia Space Cannes	TAS-F
	Klenke Uwe	ASG72		Thales Alenia Space Torino	TAS-I
	Knoblauch August	AET32			
X	Koelle Markus	ASA43		Instruments:	
X	Koppe Axel	AED312	X	MPE (PACS)	MPE
X	Kroeker Jürgen	AED65	X	RAL (SPIRE)	RAL
	La Gioia Valentina	Terma	X	SRON (HIFI)	SRON
X	Lang Jürgen	ASE252			
X	Langenstein Rolf	AED15			
X	Langfermann Michael	ASA41		Subcontractors:	
	Martin Olivier	ASA43		Austrian Aerospace	AAE
	Maukisch Jan	ASA43		Austrian Aerospace	AAEM
	Much Christoph	ASA43		BOC Edwards	BOCE
	Müller Jörg	ASA42	X	Dutch Space Solar Arrays	DSSA
X	Müller Martin	ASA43		EADS Astrium Sub-Subsyst. & Equipment	ASSE
	Pietroboni Karin	AED65		EADS CASA Espacio	CASA
	Platzer Wilhelm	AED2	X	EADS CASA Espacio	ECAS
X	Reichle Konrad	ASA42	X	European Test Services	ETS
X	Runge Axel	OTN/ASA44		Patria New Technologies Oy	PANT
	Sauer Maximilian Dr.	AED65		SENER Ingenieria SA	SEN
X	Schink Dietmar	AED32		Thales Alenia Space, Antwerp	TAS-ETCA