EADS Astrium HERSCHEL H-EPLM	ACTIVITY CONTROL SHEET	HP-2-ASED-SD-0003 Iss: 1	S.010.130/02 Page 1 of 1

Location : FN	Title:LO interface check to MTD		
Facility : Class 100	Model: PFM	Subsystem: OBA	Date: 08.02.05
CI No	Test Conductor:	Kettner	NCR Ref:
	Prepared By:	Kettner/Hendry	CIL No:

Scope: This ACS covers the activities to perform the LO and L1 flex links I/F check This ACS shall be used in conjunction with the following procedures.	**Procedures and reference documents:-** Satellite AIT Plan HP-2-ASED-PL-0025 iss 2 OBA integration Procedure HP-2-ASED-PR-0026 issue 1 FPU and JFET integration procedure HP-2-ASED-PR 0029 draft

Facilities required:	GSE:NA MGSE: Integration Dolly Inspection equipment:Visual inspection Consumables: NA	**Drawings:-**
Personnel required:	1 AIT eng 1 QA	
Safety and Hazards:	No specific safety precautions or hazards identified.	
Constraints:	Class 100 clean room EPLM mounted on Integration Dolly	

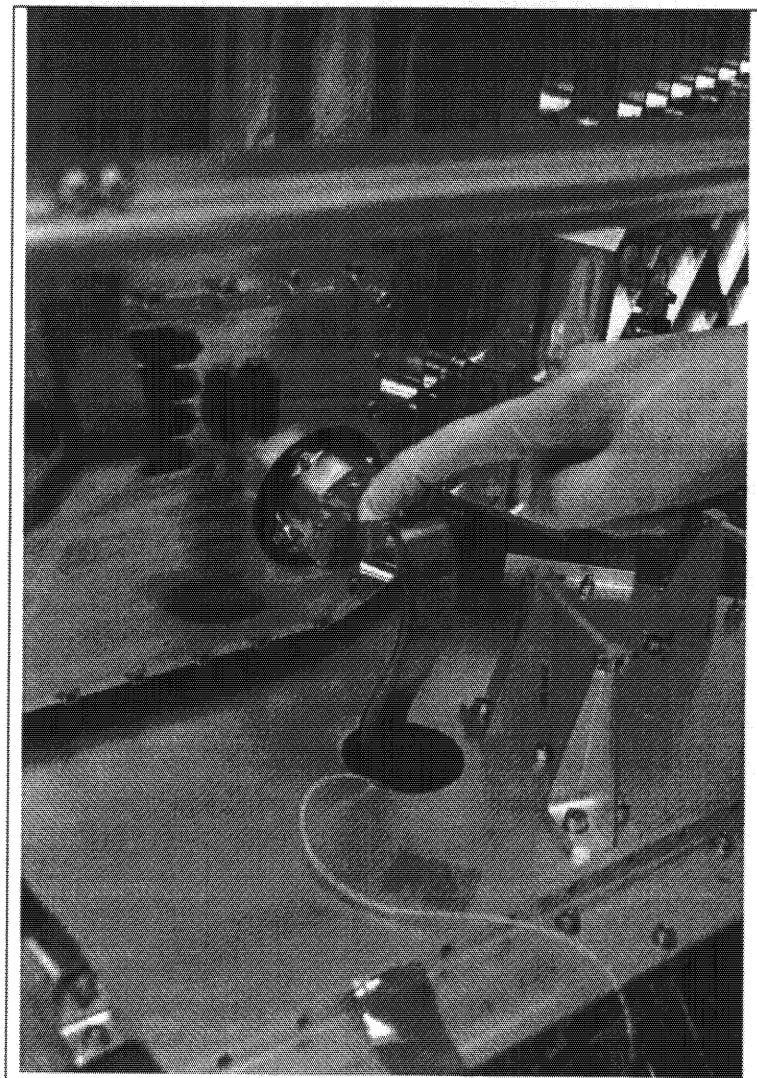
No:	Activity	Proc/Drg	Results	Responsible & sign off
01	PACS Blue detector LO		Fits without force < 2 N, clearance (10 mm) OK in all directions	Langfermann, Kettner, 31.01.05
02	PACS L1/3		Fits without force	Langfermann, Kettner, 31.01.05
03	PACS L1/2		Fits without force	Langfermann, Kettner, 31.01.05
04	PACS L1/1		Fits without force	Langfermann, Kettner, 31.01.05
05	Evaporator After pre bending measure clearance		Clearance > 10mm to OBP cut-out edge Fits with forces < 10 N in all directions for 10mm except +X where < 20 N is measured (No FM loadcase)	Langfermann, Kettner, 31.01.05

Release AIT:	Release SE:	Release PA/Safety:	Sign off (PA/QC/Team Leader)
	10/2/05		10/2/05

No:	Activity	Proc/Drg	Results	Responsible & sign off
			Moment < 0.1Nm- 0.2Nm	
06	Pump		Fits without forces < 2N for 10mm in all directions Reshaped to improve clearance to MTD now 5mm.OK MTD exceeds the allowable envelope in this area. PFM FPU will not be impacted as envelope is compliant. Moments estimated at 0.1 to 0.2 Nm it is not possible to get a more accurate measurement by hand. Moment < 0.1Nm	Langfermann, 31.01.05 Kettner Hendry 08.02.05
07	PACS Red detector		Initial fit check and re-bending on I/F simulator FX: 20N for 5mm upwards pull force using spring balance. FY: 15N for 5mm (radial) pull force using spring balance FZ: 10N for 5mm. Mzz: torque 20N x 0.025 =0.5 Nm Mxx Lateral/tangential 10N x 0.025 = 0.25Nm Myy < 0.1Nm Mzz (radial torque approx. < 0.1 N	Langfermann, 31.01.05 Kettner Hendry 08.02.05
08	Spire L0		OK no straps	Hendry, Kettner 08.02.05
09	Spire L1		OK without force	Langfermann, Kettner 31.01.05
10	Spire L3 2-JFET		Must be pre bent to get +X OK No clearance needed	Langfermann, Kettner 31.01.05
11	Spire L3 6-FET		Fits within 1mm	Gerner, Kettner 09.02.2005
12	HiFI L0		Fits within 1mm Axial FX: 5mm = 5N Lateral Fy, Fz: 5mm = < 2N Moment small approx 0.1 to 0.2 Nm	Langfermann, Kettner 31.01.05
13	HiFi L1		Fits within 1mm Forces < 2N in all directions Moment 0.1Nm to 0.2 Nm	Hendry, Kettner 08.02.05
14				

APPENDIX 1

Assessment of Flexlink I/F forces
Assessment of EQM flexlink shaping w.r.t. thermal performance
Assessment of FM flexlink shaping w.r.t. thermal performance



Fit check PACS Blue Detector

Requirement:

Requirement IIDB
Max Force:108N
Max Moment 1.8Nm

New I/F load from PACS:
PACS-ME-TN-045

Fx = 30N Mxx = 0.3 Nm
Fy = 15N Myy = 0.2 Nm
Fz = 30N Mzz = 0.3 Nm

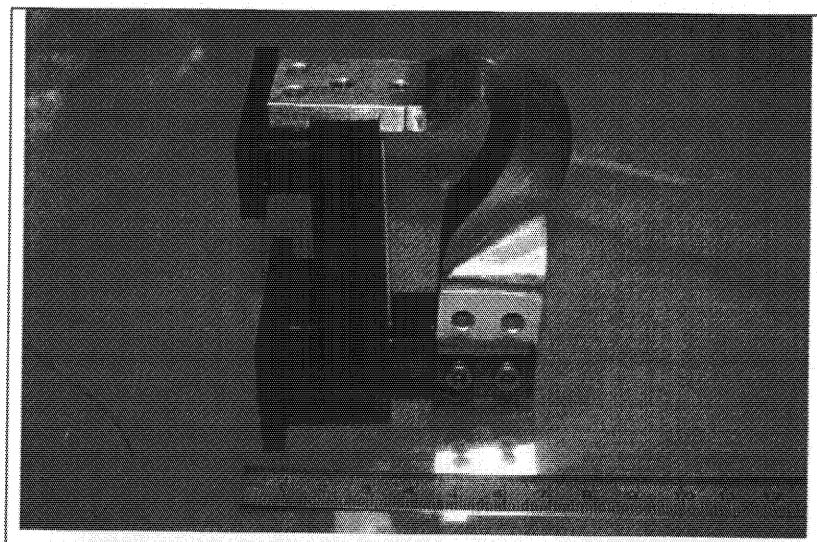
No mass requirement.

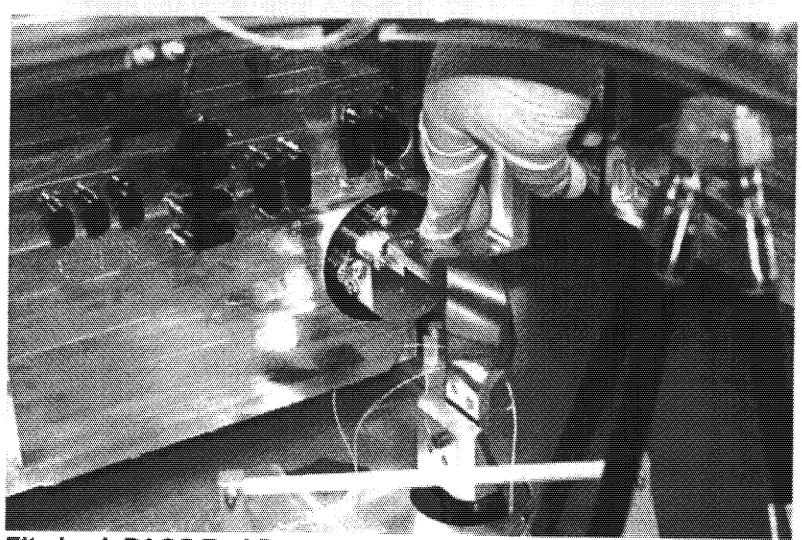
STM/FM H/W status:

Link can be fitted to MTD I/F < 1mm.
Therefore max deformation :
FM X: -4mm ; Y: 2mm and Z: 5mm
EQM: X: +4.5mm; Y: 2mm and Z: 2mm

Force assessment:
Fx,Fy,Fz <1N for 5mm in all directions
Mxx, Myy, Mzz < < 0.1Nm (no torque)

Conclusion:
Current design fulfils new PACS I/F loads





Fit check PACS Red Detector on MGSE I/F and on S/C H/W

Requirement:

Requirement IIDB
Max Force:108N
Max Moment 1.8Nm

New I/F load from PACS:
PACS-ME-TN-045

Fx = 30N Mxx = 0.3 Nm
Fy = 15N Myy = 0.2 Nm
Fz = 30N Mzz = 0.3 Nm

No mass requirement

STM/FM H/W status:

Link can be fitted to MTD I/F < 1mm.
Therefore max deformation :
FM X: -4mm ; Y: 2mm and Z: 5mm
EQM: X: +2.5mm; Y: 2mm and Z: 2mm

Actual: for 5mm in all directions

Fx = 20N Mzz = 20N*0.05/2mm = 0.5Nm (axial)

Fy = 15N Mzz = 0.1Nm
Overall Mzz: 0.6Nm

Fz = 10N Mxx = 0.25Nm

Myy < 0.2Nm

The red detector link was checked by AIRL on a force-displacement measurement machine.(See next page)
The measurement results fit well to the assessment performed at the H/W.

Conclusion:
For EM and FM a removal of 50% foils is possible which will reduce the above forces by a factor of 2.
The remaining thermal margin is:
EM: 300% at 1.7K He-Temp
EM: 1000% at 1.6K He-Temp
FM: 132%

H/W mass:
1/ 2 H/W Mass: 95gr + 6.5gr bolts+pressure +12gr Temp. sensor

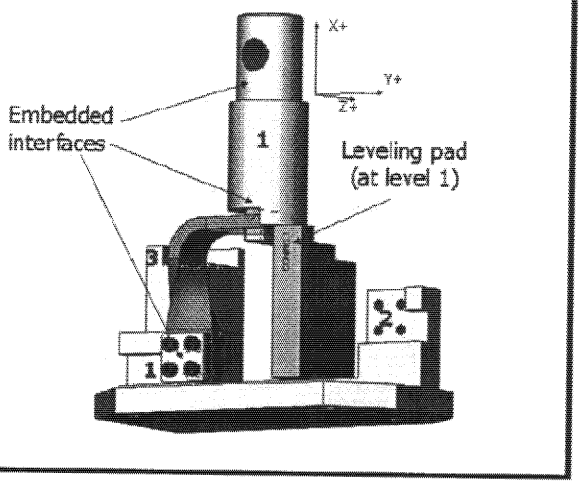
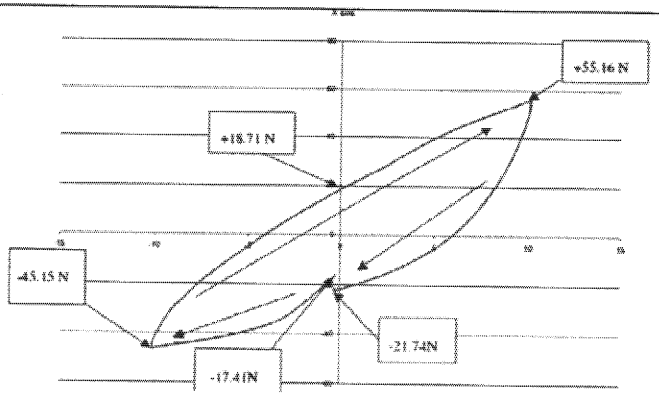


Figure 3 : Configuration N°1 – X axis

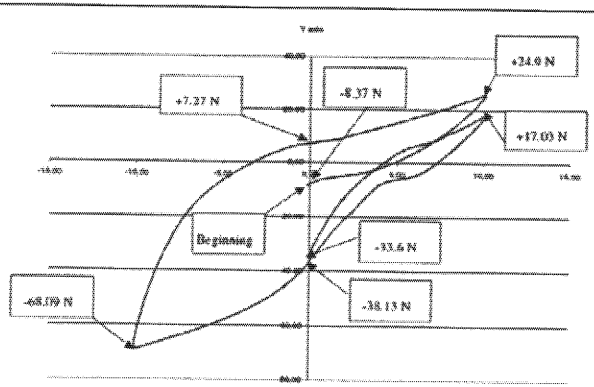
Red Detector Force Measurement set up.
(See HP-2-AIRL-TR-0005)

The fit check inspection with the FM links has shown, that all FM flexlinks can be fitted within +/-1mm to the FPU interface.
Therefore the initially 10mm max displacement can be reduced to:
FM X: -5mm Radial: 1mm and Tangential: 4mm
EQM: X: +2.5mm Radial: 2mm and Tangential:< 1mm (For red detector)
EQM: X: +4.5mm Radial: 2mm and Tangential < 1mm (For other links)

The measurement was done for +/-10mm displacement in all three directions.
Due to the excessive displacement of 20mm between min-max, the link shows a non-linear and even force progressive behaviour.
Restricting the distortion to 5mm the link is in a linear range.



Force Measurement Fx
Measured: 20N for 5mm



Force Measurement Fy
Measured: 10N for 5mm, displacement <5mm

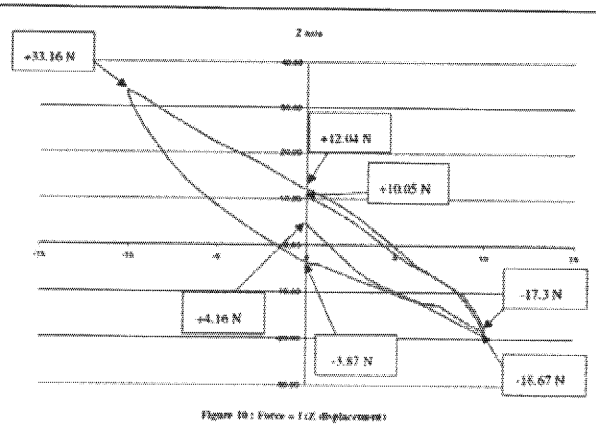
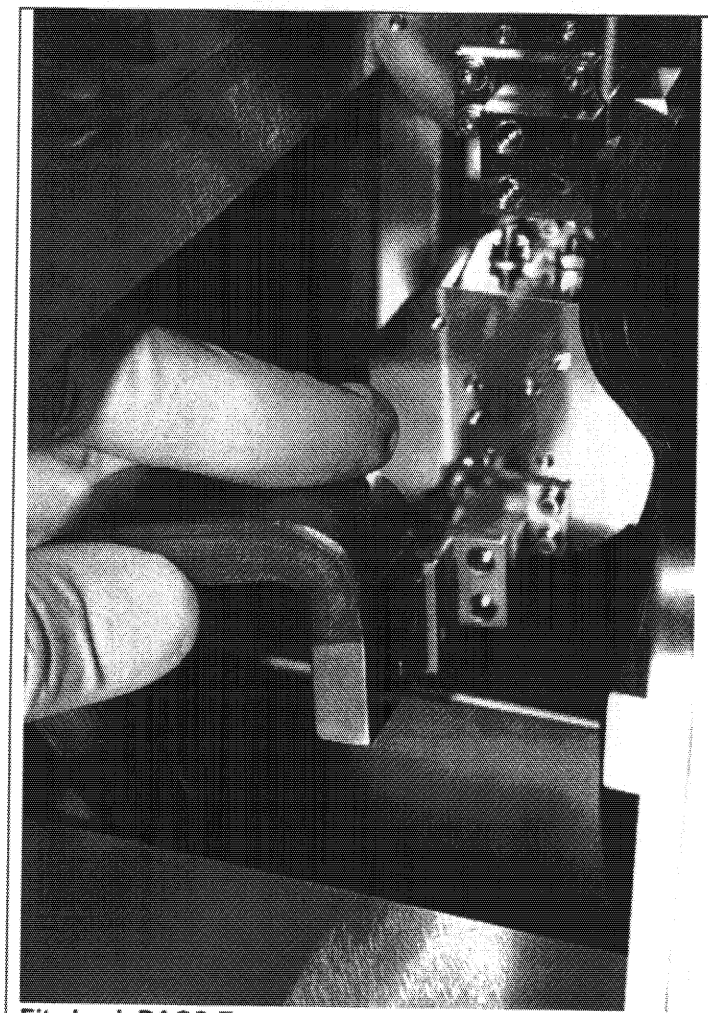


Figure 10 : Force = f(Z displacement)

Force Measurement Fz
Measured: 7N for 5mm, displacement <5mm



Fit check PACS Evaporator

Requirement:

Requirement IIDB
Max Force:50N
Max Moment -

New I/F load from PACS:
PACS-ME-TN-045, 03.02.2005

Fx = 8.6N Mxx = 0.14 Nm
Fy = 12N Myy = 0.11 Nm
Fz = 12N Mzz = 0.07 Nm

Mass requirement:
1/2 link: 150gr

STM/FM H/W status:

Link can be fitted to MTD I/F < 1mm.
Therefore max deformation :
FM X: -4mm ; Y: 5mm and Z: 2mm
EQM: X: +4.5mm; Y: 2mm and Z: 2mm

Actual: for 5mm in all directions
Fx (-x) = 5N (FM)
Fx (+x) = 10N (EM)
Fy = 5N
Fz = 5N
EQM: Myy: 10N * 0.03 = 0.3Nm
FM: Myy: 0.1Nm to 0.2Nm
Other Moments < 0.1Nm to 0.2Nm
(Threshold for manual checking)

Conclusion:
Relative low forces and moments needed for integration but probably higher than new defined PACS allowable moments.

EM:
A 37% reduction of foils will bring the moments close to the new defined I/F moments.

Actual Mass acting at FPU I/F:
150gr with bolts, w/o temp. sensor

Fit check PACS Pump

Requirement:

Requirement IIDB
Max Force:50N
Max Moment -

New I/F load from PACS:
PACS-ME-TN-045

Fx = 8.6N Mxx = 0.14 Nm
Fy = 12N Myy = 0.11 Nm
Fz = 12N Mzz = 0.07 Nm

Mass requirement:
1/2 link: 150gr

STM/FM H/W status:

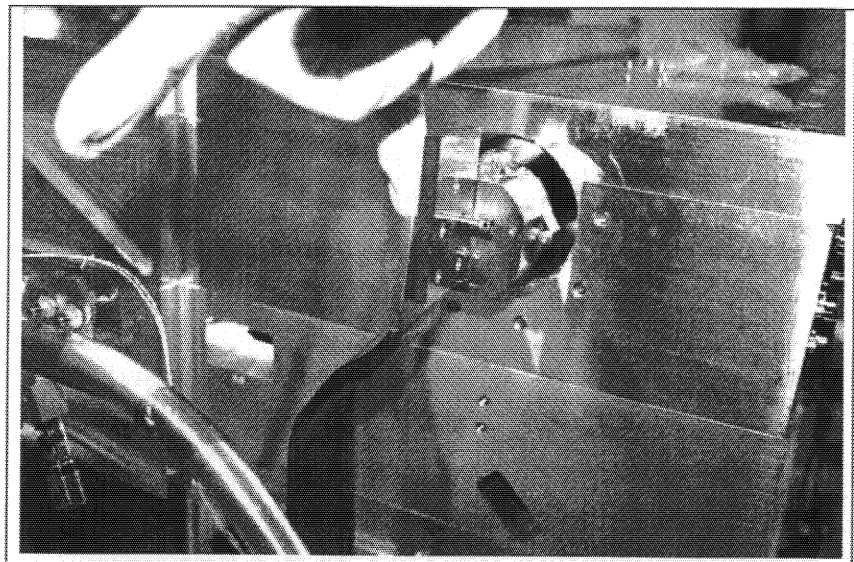
Link can be fitted to MTD I/F < 1mm.
Therefore max deformation :
FM X: -4mm ; Y: 5mm and Z: 2mm
EQM: X: +4.5mm; Y: 2mm and Z: 2mm

Actual for 5mm in all directions:
Fx < 2N
Fy < 2N
Fz < 2N

Moments < 0.1Nm
(Threshold for manual checking)

Conclusion:
Low forces and moments needed for integration

Actual Mass acting at FPU I/F:
106gr with bolts and temp. sensor



Fit check HIFI L0

Requirement:

Requirement IIDB
Max Force: No
Max Moment : No

Mass requirement:
1/2 link: 120gr

STM/FM H/W status:

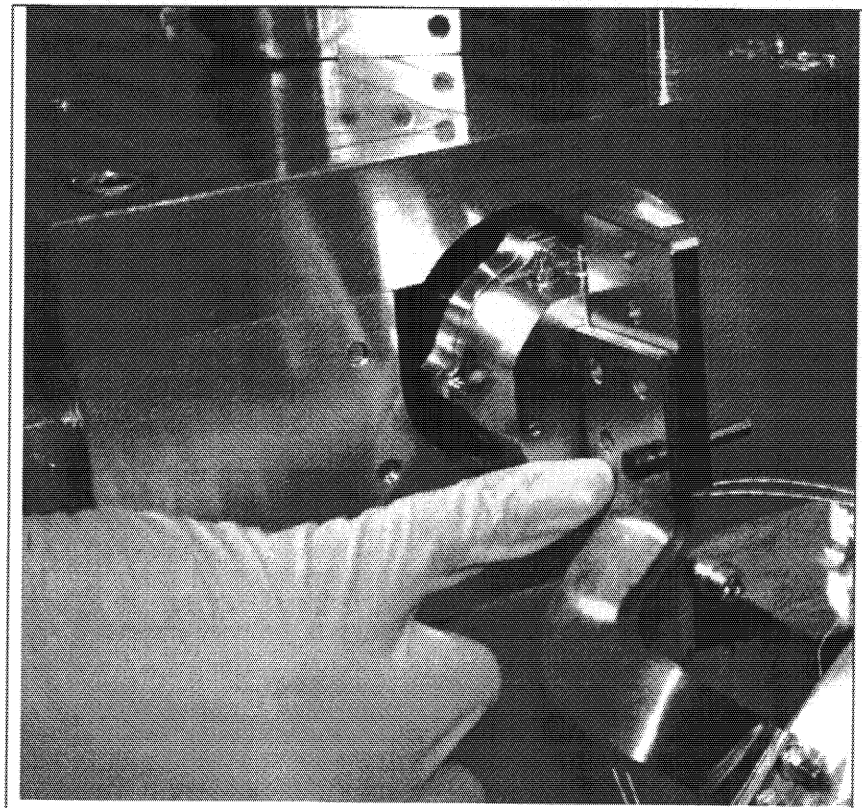
Link can be fitted to MTD I/F < 1mm.
Therefore max deformation :
FM X: -4mm ; Y: 2mm and Z: 5mm
EQM: X: +4.5mm; Y: 2mm and Z: 2mm

Actual for 5mm in all directions:
Fx < 5N
Fy < 2N
Fz < 2N

Moments < 0.1Nm to 0.2Nm
(Threshold for manual checking)

Conclusion:
Low forces and moments needed for integration

Actual Mass acting at FPU I/F: 123.5gr
With 4x ASED INVAR washers instead INVAR pressure plate. Temp. sensor shifted to rigid pod I/F



Fit check HIFI L1

Requirement:

Requirement IIDB
Max Force: No
Max Moment : No

Mass requirement:
1/2 link: 120gr

STM/FM H/W status:

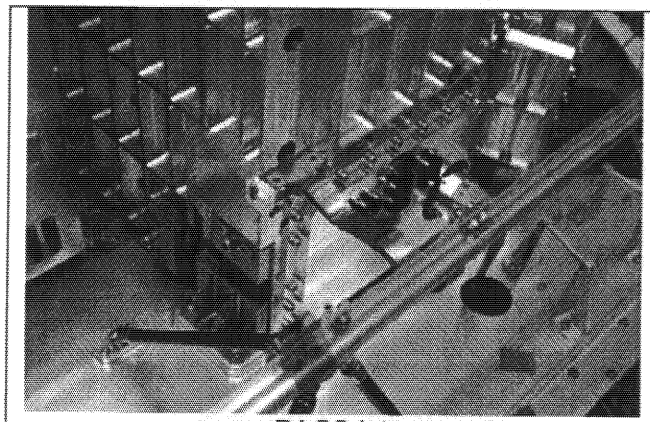
Link fits to I/F < 1mm.
Relative deformation between HIFI and cooling loop small.

Actual:
Fx < 2N
Fy < 2N
Fz < 2N

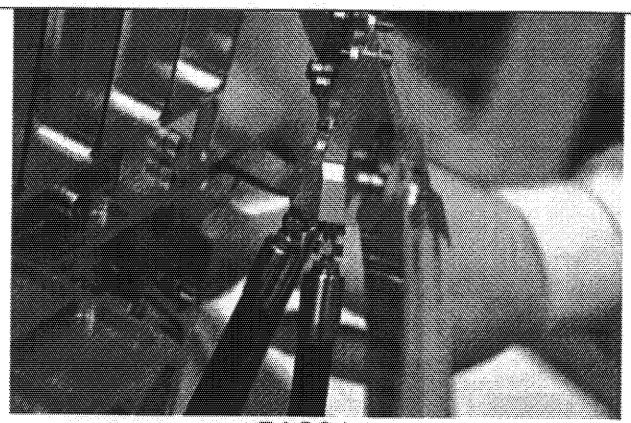
Moments < 0.1Nm to 0.2Nm
(Threshold for manual checking)

Conclusion:
Low forces and moments needed for integration

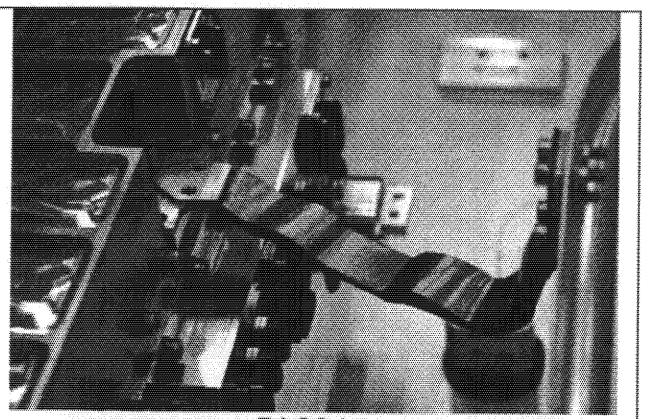
Actual Mass acting at FPU I/F:
86.5gr incl. bolts, pressure plate, temp. sensor



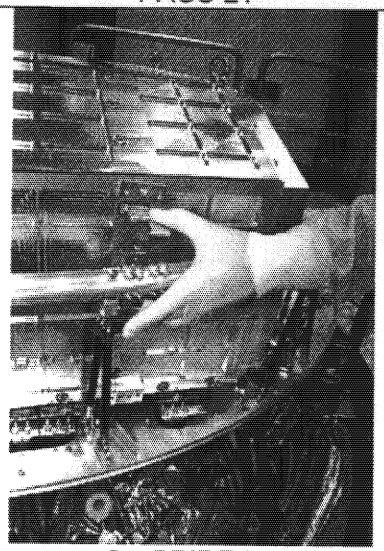
PACS L1



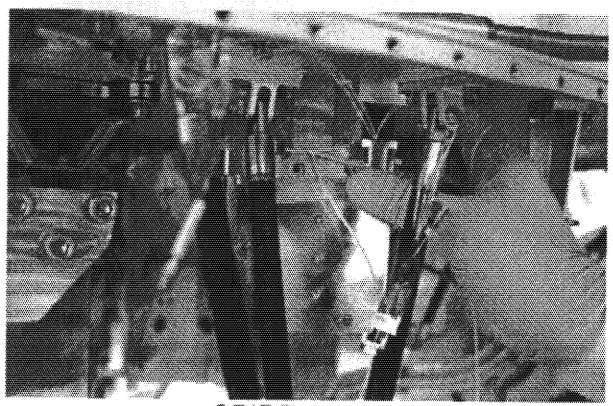
PACS L1



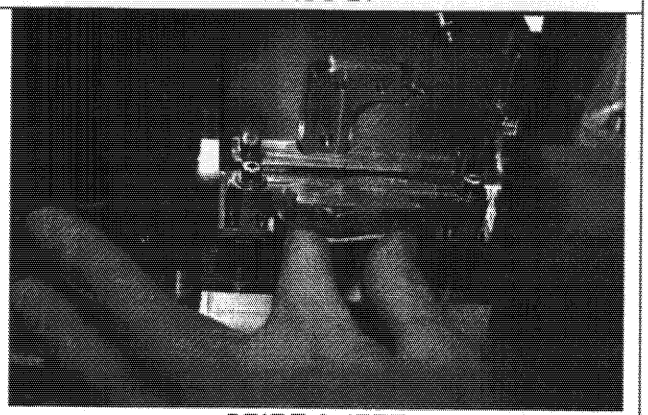
PACS L1



2 x SPIRE L1



SPIRE 6-JFET



SPIRE 2-JFET

L1 and L3 PACS/SPIRE Flexlink Fit check

	AXT Internal Contact	AXT	AXT External Contact	External Pod	IF Contact	Ext Pod / Braid Contact	Braid	Braid / Instrument contact	TOTAL	Thickness (mm)	Temp.-He	Temp.-FPU	Power flux (W/K)	Spec	Margin:		Force for about 5mm from IF	Moments	Force Requirement	Moment Requirement
Pacs Cooler Evaporator	1.E+09	1.E+09	5.92	2	1.7	3.3	0.158	1.66	**0.118**	8.00	**1.70**	1.85	0.015	**0.100**	**17.76%**			**<5N FM <10N (+X) EQM**	**<0.2Nm <0.3Nm**	**50N**	**undefined**
Reduced	1.E+09	1.E+09	5.92	2	1.7	3.3	0.099	1.66	**0.081**	**5.00**	**1.60**	1.85	0.015	**0.060**	**22.06%**	**Reduce thickness by:**	37.50%	**<3.0N FM <6N (+X) EQM**	**<0.1Nm 0.2Nm**	**tbd PACS**	
Reduced	1.E+09	1.E+09	5.92	2	1.7	3.3	0.099	1.66	**0.081**	**5.00**	**1.50**	1.85	0.015	**0.043**	**51.90%**	**Reduce thickness by:**	37.50%				
PACS Blue Detector	1.E+09	1.E+09	5.92	3.1	1.7	1.65	0.068	1.66	**0.059**	4.00	**1.70**	2.00	0.002	**0.007**	**782.66%**			**<2N**	**<0.1Nm**	**108N**	**1.8Nm**
Reduced	1.E+09	1.E+09	5.92	3.1	1.7	1.65	0.034	1.66	**0.032**	**2.00**	**1.60**	2.00	0.002	**0.005**	**467.82%**	**Reduce thickness by:**	50.00%	**Reduction not necessary but possible**			
PACS Red detector	1.E+09	1.E+09	5.92	2	1.7	1.65	0.163	1.66	**0.116**	6.00	**1.70**	1.75	0.0008	**0.016**	**626.69%**			**X<20N to I/F Y<15N Z< 2N**	**Mzz<0.6Nm worst case**	**108N**	**<1.8Nm**
Reduced	1.E+09	1.E+09	5.92	2	1.7	1.65	0.082	1.66	**0.068**	**3.00**	**1.60**	1.75	0.0008	**0.005**	**1045.19%**	**Reduce thickness by:**	50.00%	**Reduced by 50%**	**Reduced by 50%**	**tbd PACS**	**tbd PACS**
Reduced	1.E+09	1.E+09	5.92	2	1.7	1.65	0.054	1.66	**0.048**	**2.00**	**1.50**	1.75	0.0008	**0.003**	**1097.86%**	**Reduce thickness by:**	66.67%	**Reduced by 67%**	**Reduced by 67%**		
PACS Cooler Pump	1.E+09	1.E+09	5.92	7.4	1.7	3.3	0.154	1.66	**0.121**	4.50	**1.70**	10.00	0.5000	**0.0602**	**100.21%**			**<2N**	**<0.1Nm**	**50N**	**undefined**
Reduced	1.E+09	1.E+09	5.92	7.4	1.7	3.3	0.103	1.66	**0.087**	**3.00**	**1.60**	10.00	0.5000	**0.0595**	**31.05%**	**Reduce thickness by:**	33.33%	**Reduction not necessary but possible**			
Reduced	1.E+09	1.E+09	5.92	7.4	1.7	3.3	0.103	1.66	**0.087**	**3.00**	**1.50**	10.00	0.5000	**0.0588**	**17.87%**	**Reduce thickness by:**	33.33%				
HIFI L0 Detector enclosure	1.E+09	1.E+09	5.92	1.8	1.7	1.65	0.076	3.33	**0.065**	3.50	**1.70**	2.00	0.0068	**0.0227**	**186.91%**			**Fx < 5N Fy,FZ < 2N**	**<0.2Nm**	**undefined**	**undefined**
Reduced	1.E+09	1.E+09	5.92	1.8	1.7	1.65	0.054	3.33	**0.048**	**2.50**	**1.60**	2.00	0.0068	**0.0170**	**156.60%**	**Reduce thickness by:**	20.57%	**Reduction tbd by HIFI**			
Reduced	1.E+09	1.E+09	5.92	1.8	1.7	1.65	0.046	3.33	**0.041**	**2.10**	**1.50**	2.00	0.0068	**0.0136**	**143.59%**	**Reduce thickness by:**	40.00%	**Reduction tbd by HIFI**			
HIFI L1 Detector enclosure																		**<2N**	**<0.1Nm**	**undefined**	**undefined**

EQM: Potential possible I/F load reduction by shaping the EQM flexlinks

* The conductivity is globally reduced for AXT: 1.6K by 10% and AXT: 1.5K by 20% compared to AXT 1.7K

	Internal pod	HTT Internal Contact	HTT	HTT External Contact	External Pod	Ext Pod / Braid Contact	Braid	Braid / Istrument contact	TOTAL	Thickness (mm)	Temp-He	Temp-FPU	Power flux (W)	Spec	Margin:		Force	Moments	Moments	Moments	
Pacs Cooler Evaporator	1.E+09	1.E+09	1.00E+09	1.00E+09	1.00E+09	2.37	0.158	1.66	**0.136**	8.00	1.70	1.85	0.015	**0.100**	**35.99%**			**<5N FM <10N (+X) EQM**	**<0.2Nm <0.3Nm**	**50N**	**undefined**	
Reduced	1.E+09	1.E+09	1.00E+09	1.00E+09	1.00E+09	1.19	0.119	1.66	**0.101**	**6.00**	**1.70**	1.85	0.015	**0.100**	**1.16%**	**Reduce thickness by:**	25.00%	Possible Reduction for low margin				
PACS Blue Detector	1.E+09	1.E+09	0.533	0.44	0.173	1.19	0.068	1.66	**0.038**	4.00	1.70	2.00	0.002	**0.007**	**475.12%**			**<2N**	**<0.1Nm**	**100N**	**1.0Nm**	
Reduced	1.E+09	1.E+09	0.533	0.44	0.173	2.37	0.068	1.66	**0.039**	**4.00**	**1.70**	2.00	0.002	**0.007**	**484.58%**	**Reduce thickness by:**	0.00%	Reduction not necessary but possible				
PACS Red detector	1.E+09	1.E+09	0.533	0.44	0.111	1.19	0.163	1.66	**0.048**	6.00	1.70	1.75	0.0008	**0.016**	**201.36%**			**X<20N to I/F Y<15N Z< 2N**	**Mzz<0.6Nm worst case**	**100N**	**1.0Nm**	
Reduced	1.E+09	1.E+09	0.533	0.44	0.111	1.19	0.082	1.66	**0.037**	**3.00**	**1.70**	1.75	0.0008	**0.016**	**132.57%**	**Reduce thickness by:**	50.00%	**Reduced by 50%**	**Reduced by 50%**			
Reduced	1.E+09	1.E+09	0.533	0.44	0.111	1.19	0.054	1.66	**0.030**	**2.00**	**1.70**	1.75	0.0008	**0.016**	**89.34%**	**Reduce thickness by:**	66.67%	**Reduced by 67%**	**Reduced by 67%**			
PACS Cooler Pump	1.E+09	1.E+09	0.533	0.44	0.721	2.37	0.154	1.66	**0.077**	4.50	1.70	10.00	0.5000	**0.0602**	**27.17%**			**<2N**	**<0.1Nm**	**50N**	**undefined**	
Reduced	1.E+09	1.E+09	0.533	0.44	0.721	2.37	0.154	1.66	**0.077**	**4.50**	**1.70**	10.00	0.5000	**0.0602**	**27.17%**	**Reduce thickness by:**	0.00%	Reduction not necessary but possible				
HiFI LO Detector enclosure	1.E+09	1.E+09	0.533	0.44	0.069	1.19	0.071	3.33	**0.030**	3.50	1.70	2.00	0.0068	**0.0227**	**30.25%**			**Fx < 5N Fy,FZ < 2N**	**<0.2Nm**			
Reduced	1.E+09	1.E+09	0.533	0.44	0.069	1.19	0.043	3.33	**0.023**	**2.10**	**1.70**	2.00	0.0068	**0.0227**	**1.98%**	**Reduce thickness by:**	40.00%	Possible Reduction for low margin				

FM: Potential possible I/F load reduction by shaping the EQM flexlinks

For PACS Red Detector a 50% thickness reduction is possible, with remaining high margin

	Name	Dep./Comp.		Name	Dep./Comp.
X	Alberti von Mathias Dr.	AOE22		Wietbrock Walter	AET12
X	Barlage Bernhard	AED11		Wöhler Hans	AOE22
X	Bayer Thomas	AOA52			
	Fehringer Alexander	AOE13			
	Geiger Hermann	AOA52			
X	Gerner Willi	AED11			
	Grasl Andreas	OTN/AET52			
	Grasshoff Brigitte	AET12			
X	Hauser Armin	AOE22			
X	Hendry David	Terma Resid.	X	Alcatel	ASP
	Hinger Jürgen	AOE22	X	ESA/ESTEC	ESA
X	Hohn Rüdiger	AED65			
	Huber Johann	AOA52		**Instruments:**	
	Hund Walter	ASE442	X	MPE (PACS)	MPE
X	Idler Siegmund	AED432	X	RAL (SPIRE)	RAL
X	Iványi von András	FAE22	X	SRON (HIFI)	SRON
X	Jahn Gerd Dr.	AOE22			
	Kalde Clemens	APE3		**Subcontractors:**	
	Kameter Rudolf	OTN/AET52		Air Liquide, Space Department	AIR
X	Kettner Bernhard	AET42		Air Liquide, Space Department	AIRS
	Knoblauch August	AET32		Air Liquide, Orbital System	AIRT
	Koelle Markus	AOA53		Alcatel Bell Space	ABSP
X	Kroeker Jürgen	AED65		Astrium Sub-Subsyst. & Equipment	ASSE
	Kunz Oliver Dr.	AOE22		Austrian Aerospace	AAE
X	Lamprecht Ernst	OTN/ASI21		Austrian Aerospace	AAEM
	Lang Jürgen	ASE442		APCO Technologies S. A.	APCO
	Langfermann Michael	AOA51		Bieri Engineering B. V.	BIER
X	Mack Paul	OTN/AET52		BOC Edwards	BOCE
	Müller Jörg	AOA52		Dutch Space Solar Arrays	DSSA
X	Pastorino Michel	ASPI Resid.		EADS CASA Espacio	CASA
X	Peltz Heinz-Willi	AOE13		EADS CASA Espacio	ECAS
	Pietroboni Karin	AED65		EADS Space Transportation	ASIP
	Platzer Wilhelm	AED22		Eurocopter	ECD
	Rebholz Reinhold	AOA51		HTS AG Zürich	HTSZ
X	Reuß Friedhelm	AED62		Linde	LIND
X	Rühe Wolfgang	AED65		Patria New Technologies Oy	PANT
	Runge Axel	OTN/AET52		Phoenix, Volkmarsen	PHOE
	Sachsse Bernt	AED21		Prototech AS	PROT
X	Schink Dietmar	AED44		QMC Instruments Ltd.	QMC
X	Schlosser Christian	OTN/AET52		Rembe, Brilon	REMB
	Schmidt Rudolf	FAE22		Rosemount Aerospace GmbH	ROSE
	Schweickert Gunn	AOE22		RYMSA, Radiación y Microondas S.A.	RYM
	Steininger Eric	AED44		SENER Ingenieria SA	SEN
X	Stritter Rene	AED11		Stöhr, Königsbrunn	STOE
X	Tenhaeff Dieter	AOE22		Terma A/S, Herlev	TER
	Thörmer Klaus-Horst Dr.	OTN/AED65			
	Wagner Klaus	AOE22			