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Abstract: This note describes in detail the procedure to mount Analog Opto Hybrids (AOHs) in the Hamburg Petal Integration Center.

Note: This document is work in progress. Please communicate any errors/ suggestions to the authors.

Introduction

As part of the tracker project consolidation in January of 2005, the number of Petal Integration Centers (PICs) was reduced from seven to three. Petal integration can only fully start when silicone modules are available in all geometries. However, since raw petals and optohybrids are available now, the time until then can be used productively to premount optohybrids. It was decided at the 1/24-1/25/2005 TEC meeting in Aachen that optohybrids are premounted and tested in Hamburg.

The Procedure

The procedure to mount and test petals with AOHs is outlined in the following section.

1. Reception of Petals with mounted Inter Connect Boards (ICBs) from Aachen. Aachen initially sends the Petals in custom made cardboard boxes.
 - a. Petals should be mounted off-center in the frame to have more space on the side with the fiber channel!
2. Mount frame in petal grill.
3. Visual inspection
 - a. Check for possible damage during transport.
 - b. Inspect if mounting in frame still intact.
 - c. Inspect cooling points: Check for disconnected wires.
 - d. Check if all drill holes on petal are ok (only for first petals!)
 - e. Check if aluminium frame is clean.
4. Identify AOHs and perform visual inspection
 - a. Look for obvious damage like buffer ruptures, damage in isolation on laser, glue residue on fibers.

Note: It was suggested to use the laser diode from the AOH tester for optical inspection: One would send light into the fiber and look for damaged spots. However, this test only works for clear fibers. Since more than half of the fibers are green, we will not perform this test routinely.
5. Mount electrical patch panel on frame and connect LV cables to patch panel. (Note: It is not necessary to connect the HV cables!)

6. Mount optical patch panel. On the back side, the fibers (fan out for short ribbon cable) are protected by a metal box. (See picture in Appendix A).
7. Mount CCUs on ICB and test (within assembly program).
 - a. Note: There are four types of CCUs for petals with the following addresses: 0x6F CCU 1 front petal, 0x5F CCU 2 front petal, 0x7B CCU 1 back petal, 0x3F CCU2 back petal. They are sorted by type by Strasbourg. The assembly program checks if the correct CCU type is used for a given position.
8. Mount fiber clips on petal (only one side, second side when first side is mounted with AOHs).
9. Mount and test AOHs (in groups as specified by the assembly program).
 - a. Scan bar code (usually, we use the fiber bar code).
 - b. Label AOH position on connector according to: Ring, position, fiber
 - c. Mount AOHs in groups (see above).
 - d. Connect fibers to optical patch panel.
 - e. Mount hybrids for frame test.
 - f. AOH test. (including baseline test with scope). → Hamburg has looked at the gain for AOHs on the first two petals. The gains were very uniform and are around 750 mV. We currently require a minimum gain of 500.
 - g. The AOH test includes an ICB test (“frame test”) for which the hybrids are mounted (see 9e.).
10. Lay fibers in fiber clips.
11. Turn around petal in grill and repeat procedure 8-10.
12. Lay fibers in fiber channel.
13. Close off fiber channel with carbon U-profile and “passivated” capton tape, where there is no U-profile. Close off end-part with plastic profile.
14. Mount box for fiber storage during transport onto frame.
15. Remove fiber plugs from optical patch panel. Put plugs in box, layer by layer, sorted by connector on patch panel, separated by foam. Close box and screw tight. The lid puts enough pressure on the foam layers that the connectors are held in place.
16. Remove electrical cables, patch panels and close off petal frame.
17. Remove frame from grill and put frame in plastic foil. (+ silica gel). Seal off foil.
18. Store Petals in special rack.
19. Ship petals to Aachen for further distribution to PICS.
→ Rack for van in the process of being designed/built. (Will hold 2x20 petals). Tests with g-meter foreseen.
20. Download xml/database/Petal302xyzdb-CCU-AOH.xml file to database (via BigBrowser).
21. All four xml files + relevant information on assembled petals stored here:
<http://wwwiexp.desy.de/elog/AOH-Assembly/>

Schedule

We foresee the following schedule for premounting AOHs in Hamburg. The project should take 9 months plus 2 months contingency. Prerequisites for being able to hold to this schedule are:

We have two working assembly setups at all times.

- Spare components in case of hardware failure have to be available (either locally or centrally for all PICs).

- Enough material in hand to maintain continuous rate: Petals (Aachen), AOHs (Vienna), CCUs (Stassbourg).
- ICB/Petal repairs are done in Aachen.

We have assembled petals ~routinely on assembly line 1 since 2/28 and on line 2 since 3/8. As of April 1, 14 petals have been mounted in Hamburg

Status of hardware:

Both assembly lines are working and “in production”. However, we have experienced problems with the Low Voltage cables and Molex connectors that are currently being addressed.

For the status of the Hamburg PIC with respect to Guido’s list see separate document linked from the same WEB page.

Assembly Program

The assembly program has been modified to comply with the new scheme of premounting AOHs in Hamburg and mounting modules elsewhere. These changes have been implemented:

- Database prepared for new mounting scheme. The assembly program now produces two separate database xml files: One for AOH mounting, one for module mounting. We upload the AOH xml file to the database and make all four xml files produced by the assembly program (the two database files and the longterm and the logbook file) available on the WEB for further use by the PICs mounting modules.

Petal reception at PICS

To avoid late surprises, we want the petal integration centers to inspect the first petals sent by Hamburg. This is specially important since we will have mounted AOHs on a large number of petals before the PICs have a chance to mount the first modules.

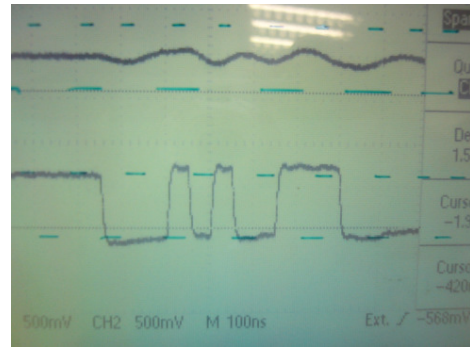
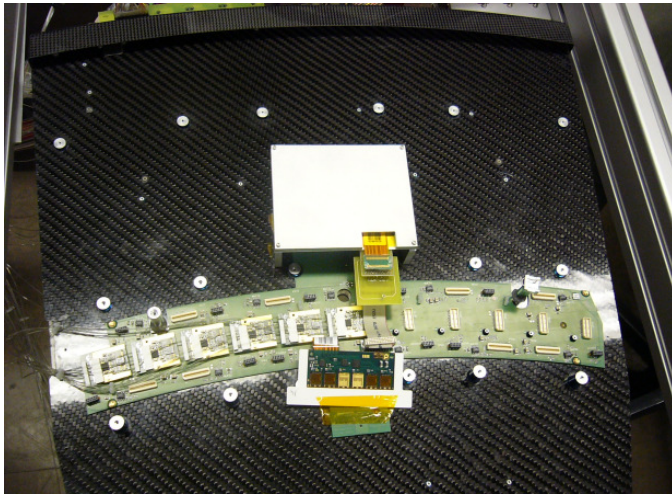
Repair scheme

If we detect problems on an ICB on a petal, we plan to send the petal back to Aachen for repair. If a petal integration center sees problems with an AOH, they should send the petal back to Hamburg for repair. (At least initially).

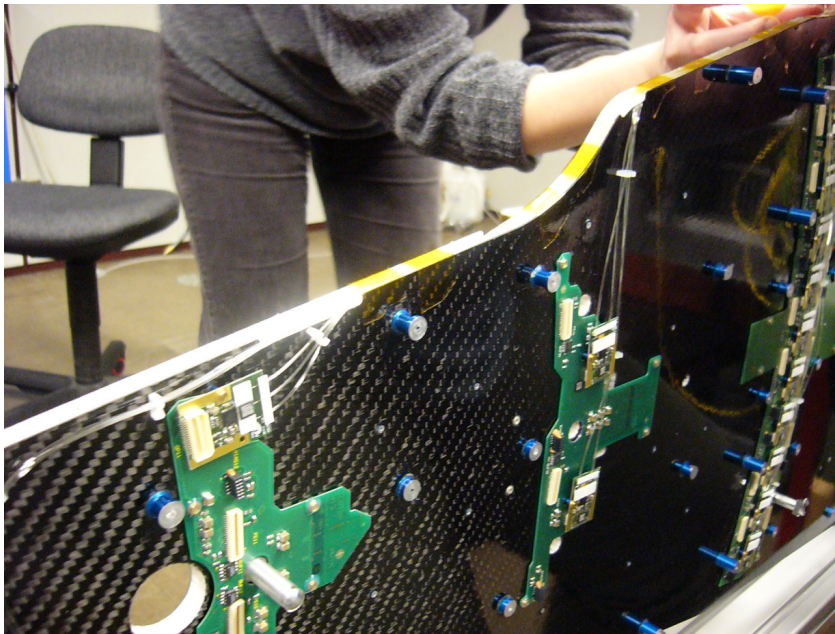
Appendix A: Pictures

Enclosed are a few pictures that illustrate our setup.

ICB/Frame Test



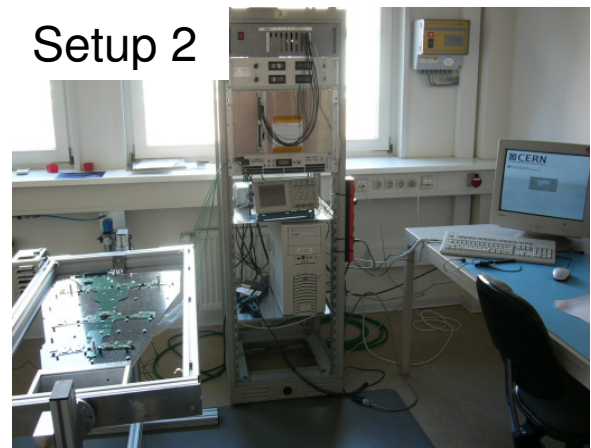
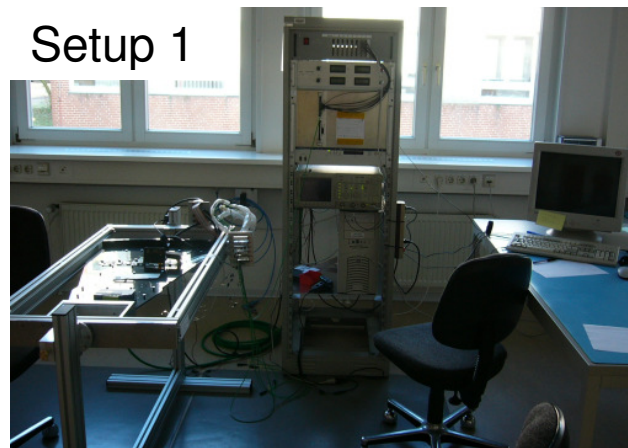
As part of the AOH tests implemented in the assembly program, a test with hybrids is performed. Triggers are being generated by the TSC - FEC and sent to the hybrid. The picture on the right shows the trigger frame as seen on an oscilloscope. The oscilloscope is triggered externally with the “Pulser out” output on the TSC (third Lemo connector).



Storing away fibers in fiber channel. (Picture taken in Aachen).



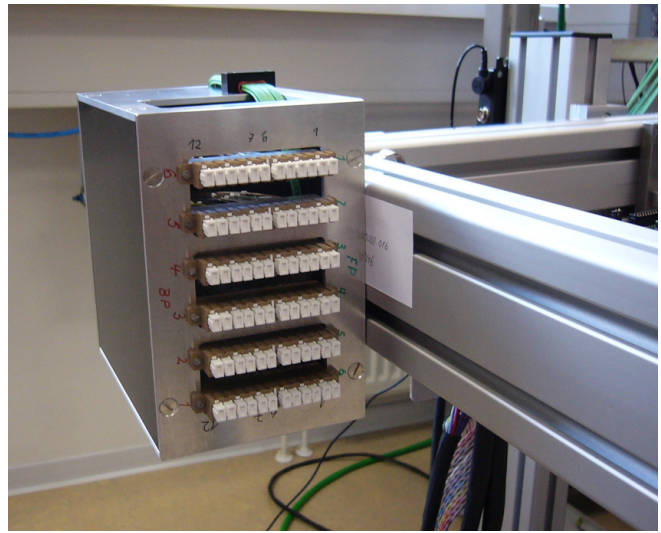
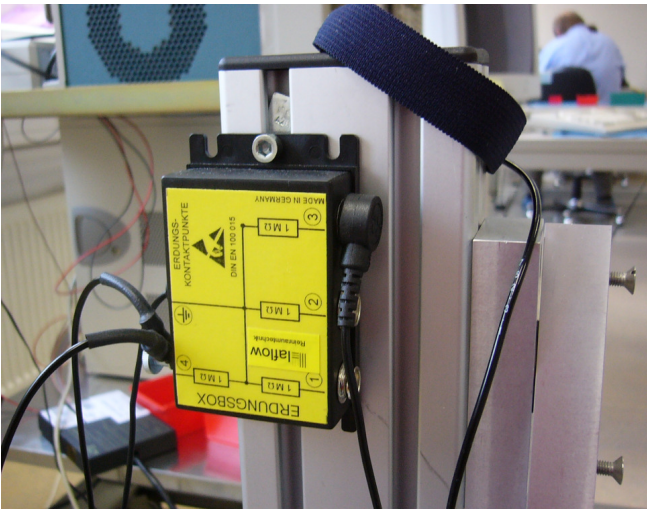
Grey room with air filter unit and humidity control in Hamburg.



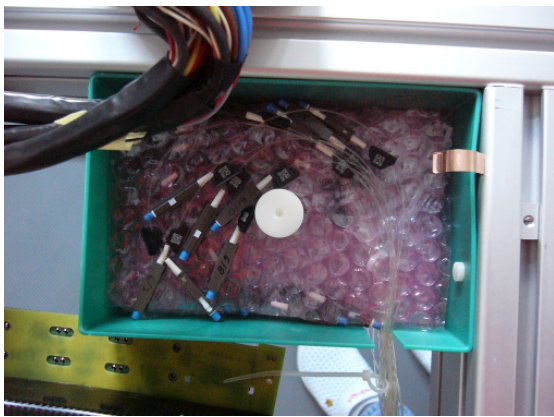
Assembly setups in Hamburg.



Storage for 30 petals (left) and AOHs (right).



ESD protection (left) and protection for fibers (short ribbon fanouts) (right).



Fiber storage during transport (left). Welder for plastic foil to seal petals during transport (right).



AOH test station with dedicated scope.

Appendix B: AOHs needed.

In this section the AOH situation is summarized. Table 3 lists the number of AOHs by type needed for each petal. Table 4 lists the availability of AOHs in Hamburg as of January 24, 2005. As can be seen from this table, the 3 laser long type AOHs are scarce, even when including the anticipated 2005 production. Hamburg is in the process of requesting back unused AOHs that were previously sent out to various centers (as listed in the bottom part of table 4).

Type	Front 1-3	Front 4-6	Front 7-8	Front 9	Back 1-3	Back 4-6	Back 7-8	Back 9
total # petals	48	48	32	16	48	48	32	16
2 laser - 35cm	2	2	2	2	1	1	1	1
2 laser - 56cm	2	2	2	2	2	2	2	2
2 laser - 70cm	5	5	5	5	4	4	4	4
2 laser - 80cm	4	4	4	3	3	3	3	2
2 laser - 88cm	2	2	2	1	3	3	3	2
2 laser - 100cm	1	1	1	0	0	0	0	0
3 laser - 56cm	1	1	1	1	2	2	2	2
3 laser - 70cm	2	2	2	2	2	2	2	2
3 laser - 80cm	1	1	1	1	2	2	2	2
3 laser - 88cm	2	2	0	0	2	2	0	0
3 laser - 100cm	2	2	0	0	1	0	0	0
3 laser - 110cm	3	0	0	0	1	0	0	0
3 laser - 120cm	1	0	0	0	0	0	0	0

Table 3: AOHs needed for each petal type.

	2-L 350	2-L 560	2-L 700	2-L 800	2-L 880	2-L 1000	3-L 560	3-L 700	3-L 800	3-L 880	3-L 1000	3-L 1100	3-L 1200	Total
sent by Vienna (not exclusively to HH)	351	506	591	360	451	197	206	216	134	110	61	121	107	3411
Sent by HH	23	27	60	60	40	6	15	35	20	27	30	38	7	388
AOHs in HH	317	478	531	300	409	143	189	178	114	83	31	83	62	2918
Q4/2004 prod.				750			120	200	250	200	100			1620
Q1/2005 prod.	200	130	460											790
Q2/2005 prod.			400		315		190	235	100	120	110	100		1570
total (AOHs in HH + 05 prod.)	517	608	1391	1050	724	143	499	613	464	403	241	183	62	6898
Front 1-8	256	256	640	512	256	128	128	256	128	192	192	144	48	
Front 9	32	32	80	48	16		16	32	16	0	0	0	0	
Back 1-8	128	256	512	384	384		256	256	256	192	48	48	0	
Back 9	16	32	64	32	32		32	32	32	0	0	0	0	
AOHs needed for all Petals	432	576	1296	976	688	128	432	576	432	384	240	192	48	6400
excess	85	32	95	74	36	15	67	37	32	19	1	-9	14	498
from bad batch	27													
AOHs Sent by HH														
AOHs in other centers														
Aachen	6	8	20	17	12	2	4	8	5	8	8	11	4	113
Karlsruhe	8	9	23	19	12	2	5	9	5	9	9	10	1	121
Hamburg				1					1					2
Antwerpen	5										3			8
Straßburg	4	4	10	7	5	2	2	4	2	4	4	6	2	56
Lyon		4	7	5	5		3	4	3	4	4	5		44
CERN/Repair Buffer rupture		2		11	6		1	10	4	2	2	6		44
Total	23	27	60	60	40	6	15	35	20	27	30	38	7	388
from bad batch	23												7	

Table 4: Availability of AOHs.