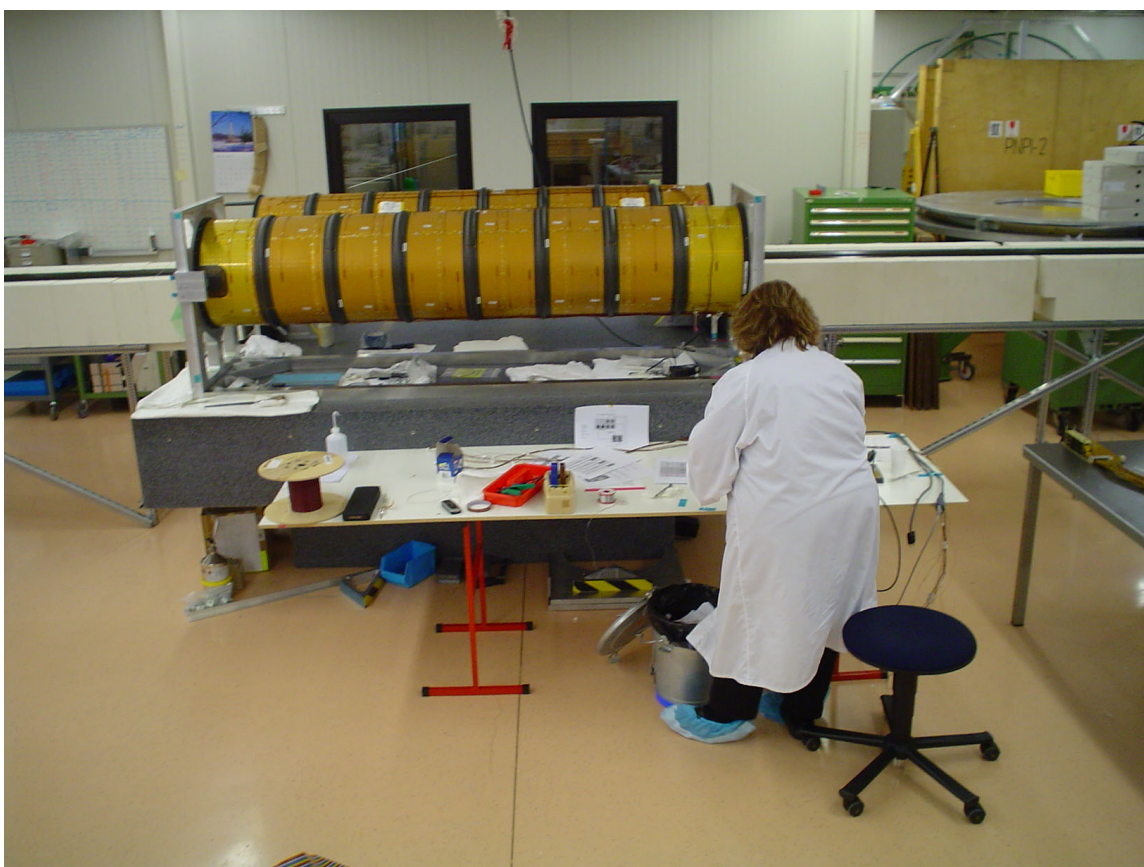


Trial Insertion at CERN Log

November 4, 2006

Setup has been in progress since Monday October 30 but today is the first day when logging results is needed. The setup is illustrated in the photos below. The PP1 end of the BPSS is to the left in the picture. The first shell, closest to the camera in the picture, is in the mount jig. The second shell is supported by aluminum angles on the granite table. Unistrut-like frames support the rails-on-foam on each side. This is BPSS A. And PST A.



This is a view from the PP1 side.



This is a view from the PP0 end of the BPSS.

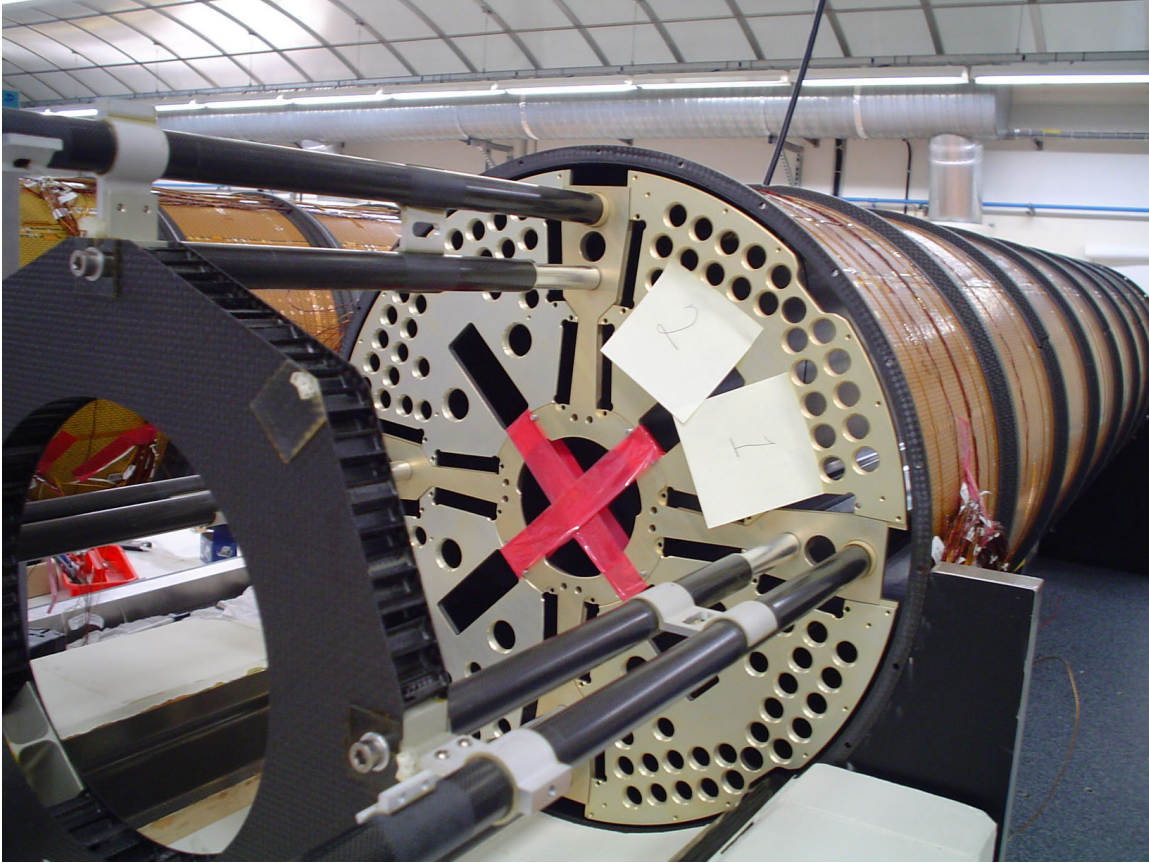


This is a closer view so that the rail orientation can be seen.



The first step is to measure clearances at the quarter plate with no loads on the BPSS ie nothing but the BPSS and the cruciform+quarter plate. Measurements are taken at the approximate center of each octant. The clearance is measured from the quarter plate in each octant to the shell.

The orientation of the measurements can be understood from the pictures below. Measurements with the BPSS outside the shell as shown below in the two pictures.



Measurements with the BPSS inside the PST shell then are as shown below.



First measurements – in mm.

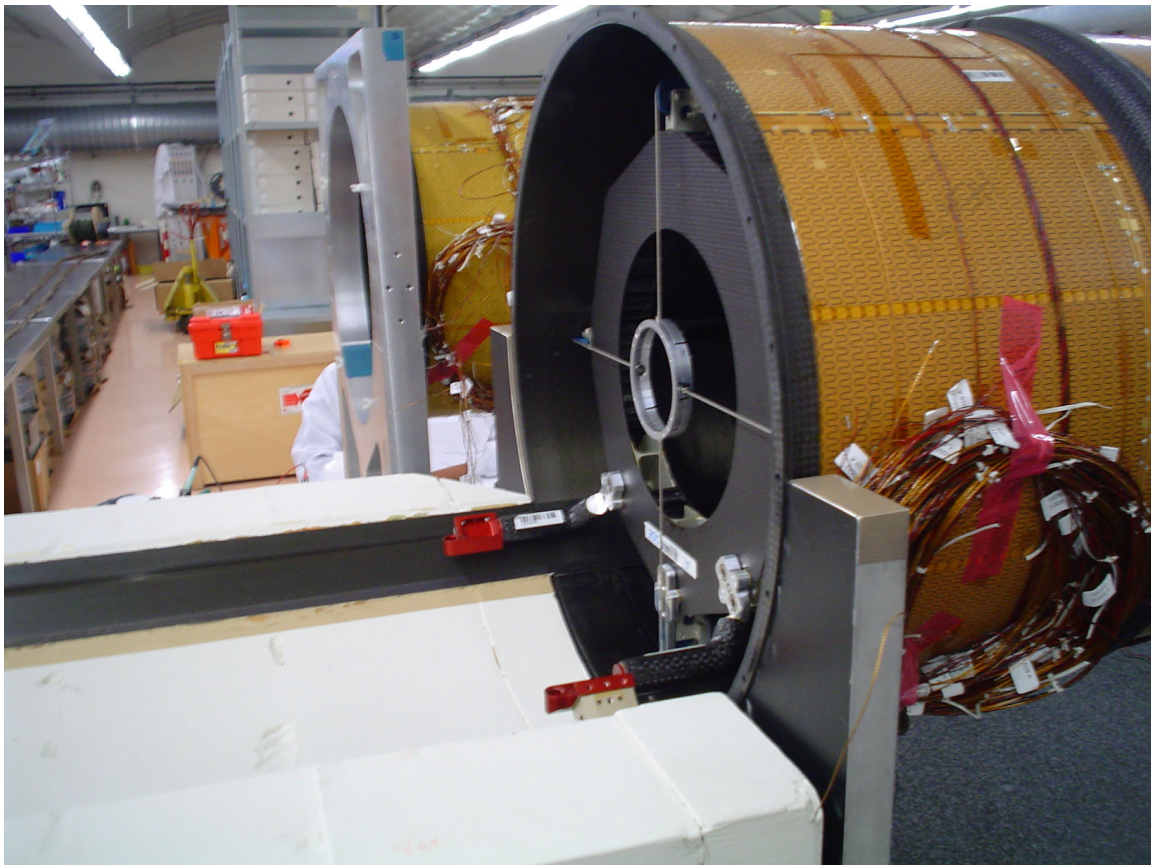
Measurement Point	BPSS Outside Shell	BPSS Inside Shell
1	3.42	2.58
2	3.29	3.15
3	3.20	4.01
4	3.02	4.15
5	3.01	3.56
6	Can't measure	Can't measure
7	Can't measure	Can't measure
8	3.20	2.18

Do exactly the same thing again to check consistency. Move BPSS in and out.

Measurement Point	BPSS Outside Shell	BPSS Inside Shell
1	3.55	2.54
2	3.35	3.19
3	3.20	4.14
4	2.98	4.17

5	3.00	3.61
6	Can't measure	Can't measure
7	Can't measure	Can't measure
8	3.35	2.17

The measurements are quite consistent. The BPSS outside shell measurement shows that we can reasonably align the foam blocks to center the cruciform/quarter plates, since in this configuration the BPSS riders are entirely on the foam blocks. The measurement with the BPSS inside the shell shows a problem namely not centered to the desired accuracy. In the BPSS-inside-the-shell configuration the rail riders on the PP0 end are on the foam blocks – see below.



We did a number of measurements to understand if the BPSS structure is centered in the PST. Measurements to the longerons, blocks on the longerons, etc. It appears that BPSS is off center to roughly the left by about 1mm. Top to bottom comparisons are hard because it's hard to measure on the bottom with what we have. Getting tired. Need to do a consistent set of measurements next.

November 6, 2006

Decided to check alignment, hot melt to secure and repeat clearance measurements around quarter plates and then start adding weight. Having trouble finding scale!

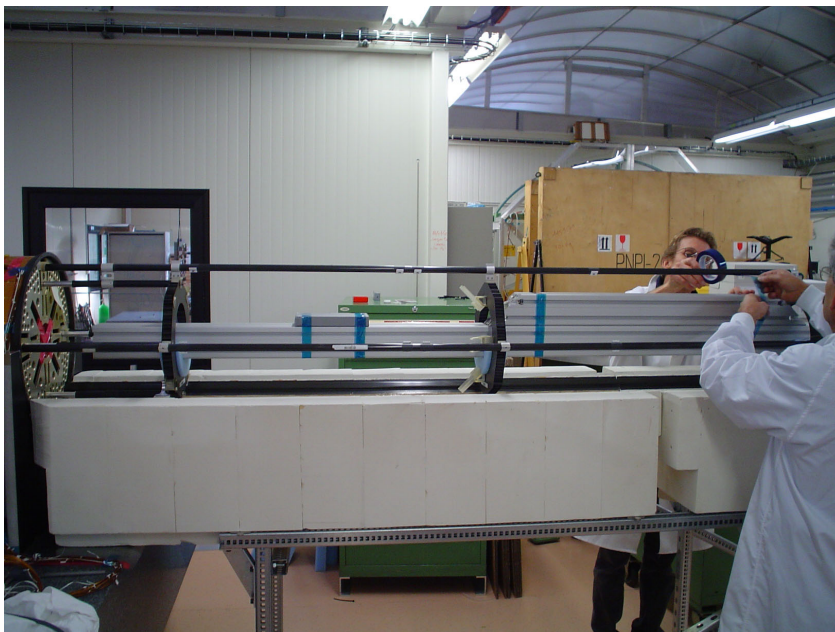
Did some adjust of rails on side with BPSS out. This changed the outside-shell measurements

Measurement Point	BPSS Outside Shell	BPSS Inside Shell
1	2.90 was 3.42	2.75 was 2.58
2	3.20 was 3.29	3.24 was 3.15
3	2.93 was 3.20	4.13 was 4.01
4	3.85 was 3.02	4.07 was 4.15
5	3.76 was 3.01	3.39 was 3.56
6	Can't measure	Can't measure
7	Can't measure	Can't measure
8	2.61 was 3.20	2.29 was 2.18

Decide to adjust rails to center with BPPS outside shell. Here are the results – note both are outside. First column is as adjusted. Second is after hot melt, should be the same.

Measurement Point	BPSS Outside Shell	BPSS Outside Shell
1	3.23	3.30
2	3.27	3.13
3	3.38	3.55
4	3.41	3.22
5	3.35	3.30
6	Can't measure	Can't measure
7	Can't measure	Can't measure
8	3.03	3.00

Looks the same within error of using calipers. Next step is to add weight. Putting 25 kg inside the BPSS – see photo below.



Measurements in this condition.

Measurement Point	BPSS Outside Shell	BPSS Inside Shell
1	2.85	3.37
2	3.42	3.53
3	4.15	3.67
4	4.15	3.22
5	3.37	3.03
6	Can't measure	Can't measure
7	Can't measure	Can't measure
8	2.33	3.13

Looks like weight moved things around. Do these again to check. Above flopped

Measurement Point	BPSS Outside Shell	BPSS Inside Shell
1	2.85	2.76 was 3.37
2	3.42	3.40 was 3.53
3	4.15	4.14 was 3.67
4	4.15	4.15 was 3.22
5	3.37	3.36 was 3.03
6	Can't measure	Can't measure
7	Can't measure	Can't measure
8	2.33	2.32 was 3.13

So the real table is

Measurement Point	BPSS Outside Shell	BPSS Inside Shell
1	3.37	2.85
2	3.53	3.42
3	3.67	4.15
4	3.22	4.15
5	3.03	3.37
6	Can't measure	Can't measure
7	Can't measure	Can't measure
8	3.13	2.33

The cruciform is now not fully aligned, flush with end of PST. Loosen trantorques and align by hand. The measurements inside shell only are given below. Not much change.

Measurement Point	BPSS Outside Shell	BPSS Inside Shell
1		2.75
2		3.24
3		4.01
4		4.06
5		3.44

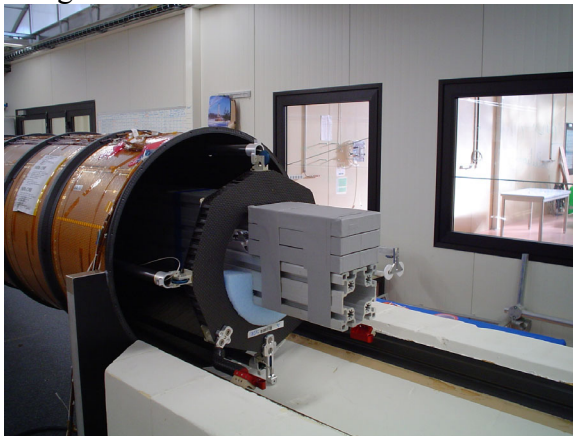
6		Can't measure
7		Can't measure
8		2.30

We then got cans and spent time putting them on and understanding clearances. Need to modify ears on stay clear that goes above rails, file them off a bit. One picture of the setup is here and the rest can be found via the wiki link. Waiting for endplate with riders.

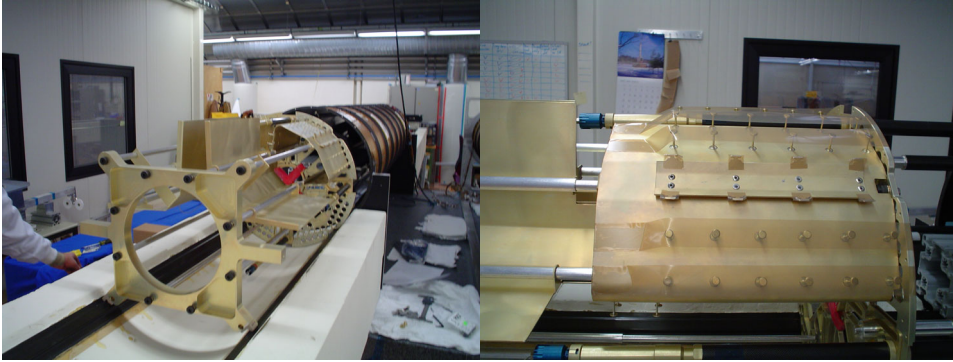


November 7, 2006

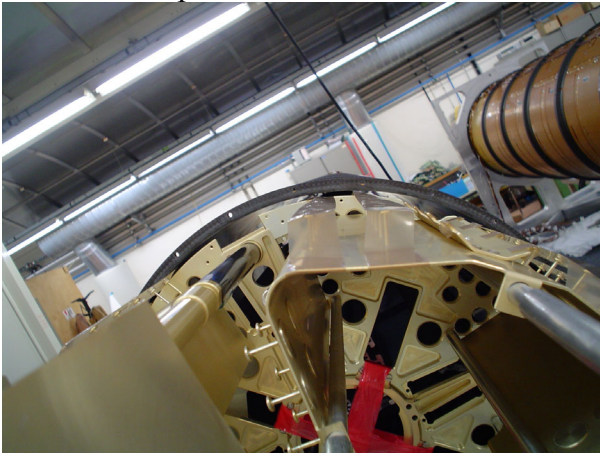
Weight added to simulate frame. See below.



Rider to hold back of buckets arrived yesterday. Buckets, cans, riders assembled. See below.



Note teflon tape across the buttons – see below.



The two cans are mounted on the top. Pushed BPSS through. No weight on cans. Passed through without touching but visual clearance tight in some spots. Decided to use shims to get rough measure of clearance. All measurements are orientation looking into shell from BPSS out side that is from the right into the shell as shown in first picture in this log. Measure clearance to buttons.

No weight in bucket
BPSS out. First button just inside shell.

	Clearance(mm)	
1	2.5	Near Horiz - right
2	1.65	
3	2.5	
4	>2.5	Near Top right
5	2	Near Top left
6	1.25	
7	2	

8	>2.5	
---	------	--

Inside until first rider just engages in PST. No weight in buckets

	Clearance(mm)	
1	1.25	Near Horiz - right
2	Tight 0.75	
3	2.25	
4	>2.25	Near Top right
5	>2.25	Near Top left
6	>2.25	
7	>2.25	
8	>2.25	

Push to near other end as far from other end as we can reach. No weight

	Clearance(mm)	
1	2.25	Near Horiz - right
2	1.5	
3	2.25	
4	>2.25	Near Top right
5	>2.25	Near Top left
6	>2.25	
7	>2.25	
8	>2.25	

Push to buttons at flange other end. No weight.

	Clearance(mm)	
1	>2.25	Near Horiz - right
2	2.25	
3	1.75	
4	2.25	Near Top right
5	>2.25	Near Top left
6	>2.25	
7	>2.25	
8	>2.25	

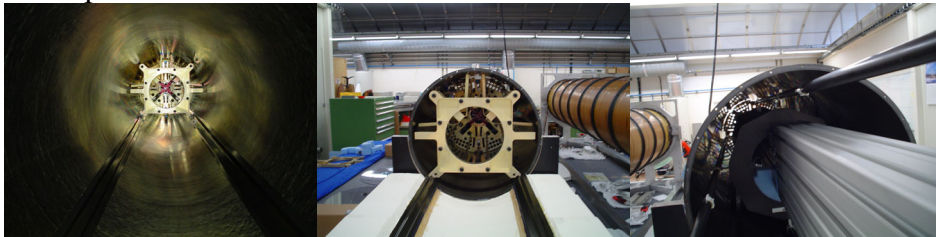
We then put 25kg in the bucket region to simulate connectors and cables. Clearly this deflects the cans significantly. The measurements below should be compared with the table just above.

	Clearance(mm)	
1	3.02	Near Horiz - right
2	3.21	
3	3.07	
4	3.57	Near Top right
5	4.32	Near Top left
6	3.84	

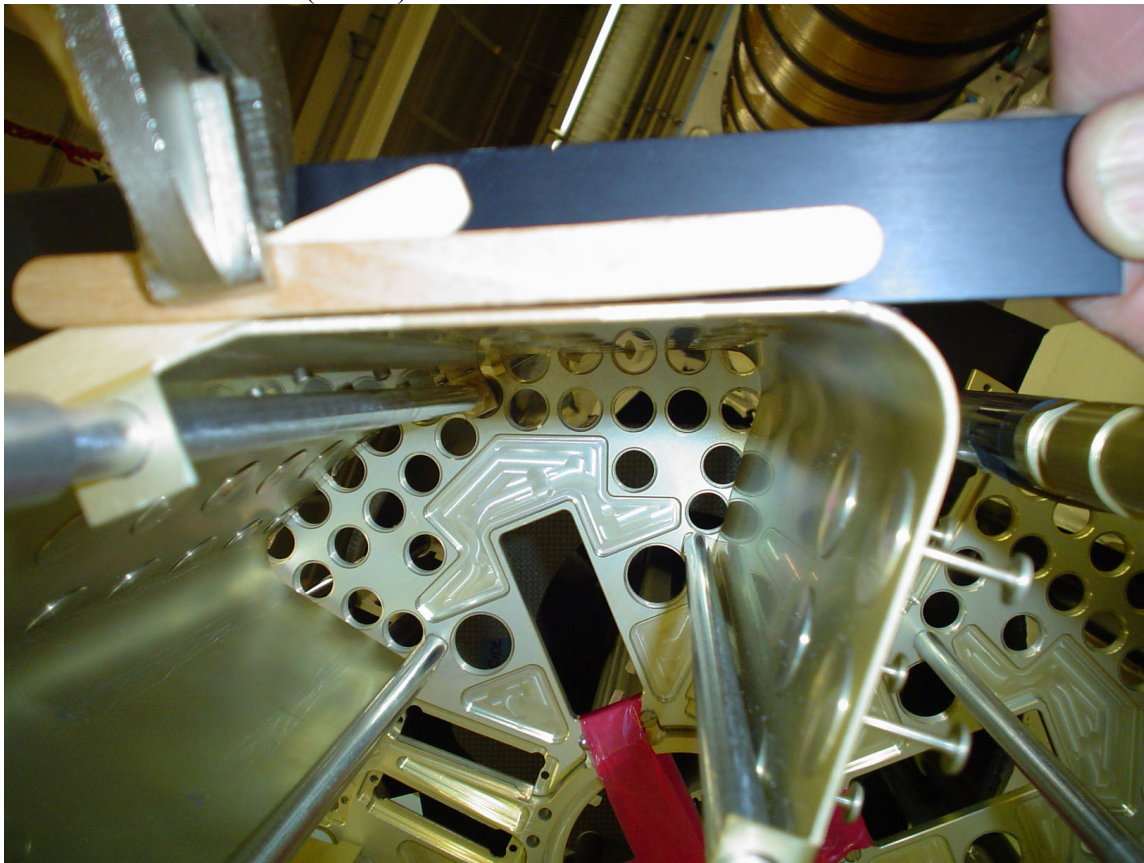
7	3.76	
8	3.70	

We pushed this through shell but did not make any more measurements. Obviously would clear.

Some pictures follow.



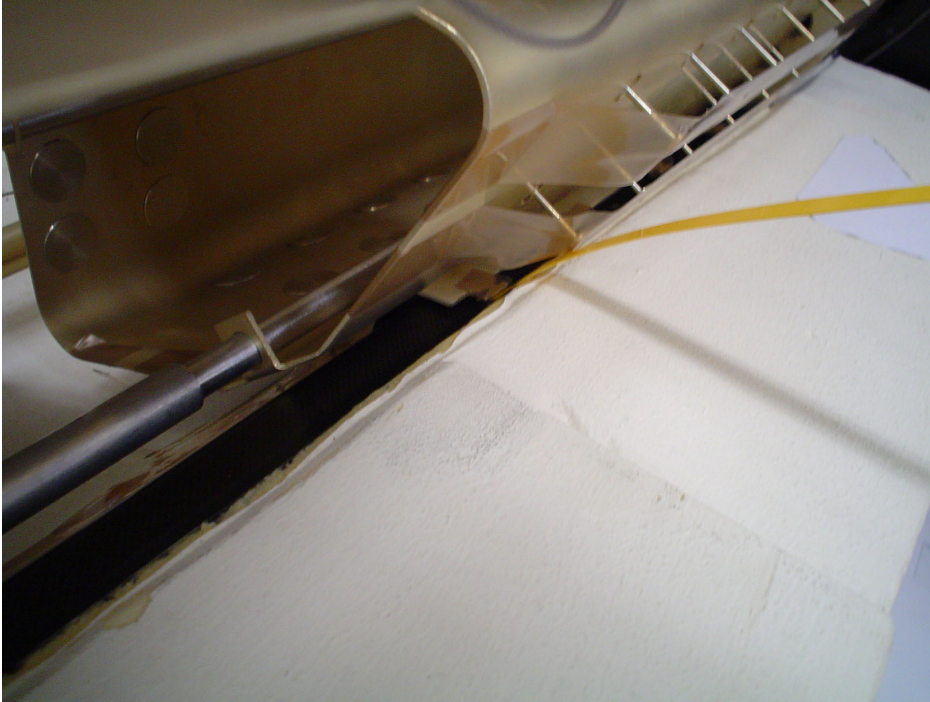
Cans and so forth were then moved to bottom but clear clearance would be problem and seeing clearance. Some investigation shows that can faces are not the same, namely buttons are higher on one face than the other. The angles of the faces are also slightly different as can be seen(sort of) below



The buttons to the left in this picture are higher on the left face in this picture than the right face. This seems to explain part of the clearance difference.

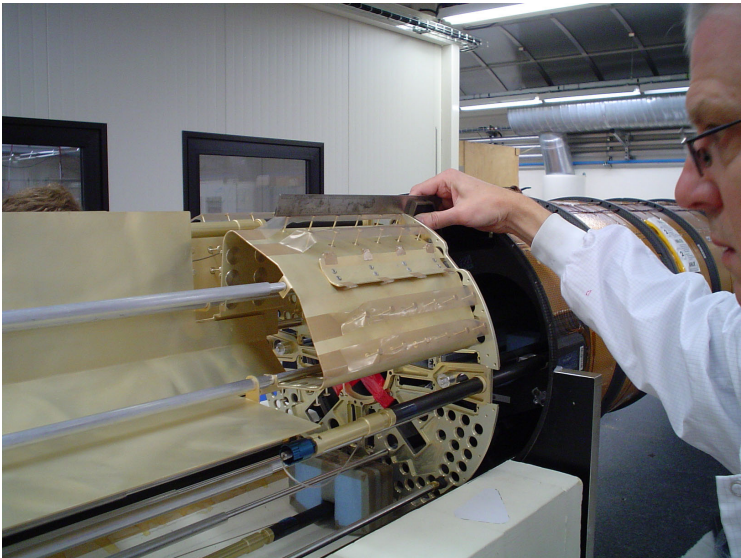
November 8, 2006

A can was put on the bottom. Since one face is slightly tilted the buttons are high on this face. Decided not to try to roll in but figure out how to move buttons down. Clearance between ears on clearance piece and rail only about 0.5mm. Too small, could bend ears toward can or remove more material. See picture below.

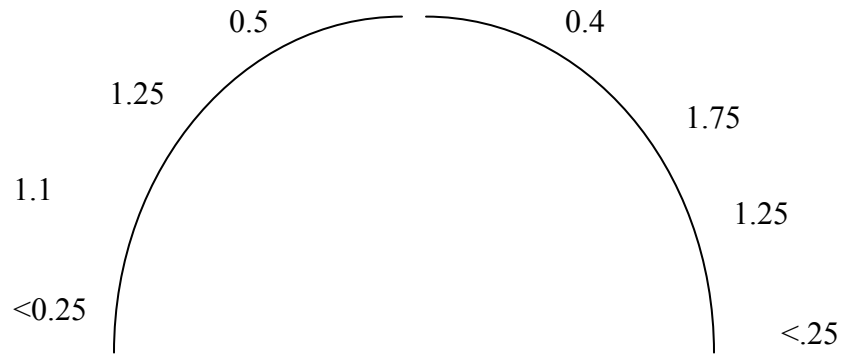


Lots of thinking. In the end, rest tab on one section of can on 3mm bolt that goes into quarter panel rather than on 6mm registration feature. This moves can slightly inward at that point. Then can seems to want to naturally go in this direction ie. when rods are loose.

Clearance between straight edge on buttons and quarter plate was measured roughly with shims.



Looking into shell from end shown in picture above. The buttons are above the quarter plate as shown below



Added the 25kg to simulate connectors and wires and slide in a bit. The end region sags so there is plenty of clearance. But the quarter plate next to the V-rail is very tight. Clearance to the rail is <0.5mm in worst spot. Pulled back out and think about what to do about this. Note that we did slide all the way through this way, should inspect the rails!

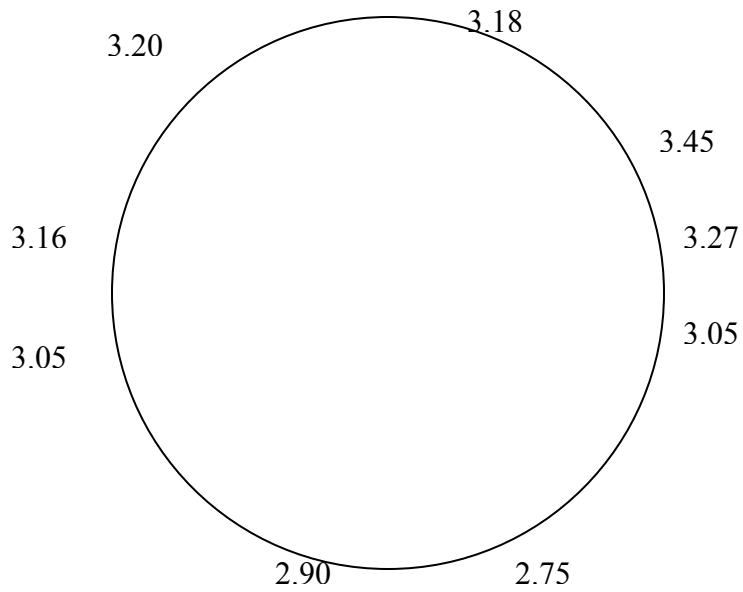
Decided to try to modify spare riders to attach to bottom quarter plates.

November 9, 2006

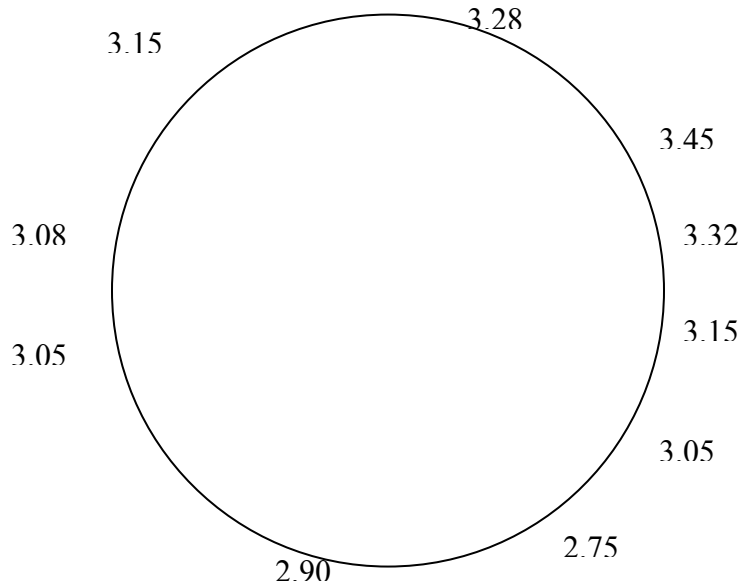
Modified riders were made and attached. See photos below.



Clearances between quarter plate and shell with 11kg are given below

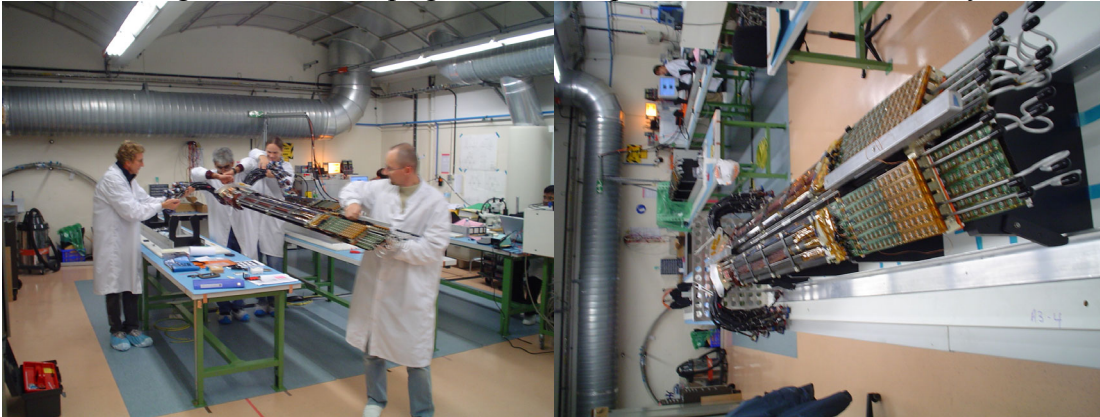


Clearances with 25kg are given below



Pushed through without weight. Clearance looks good! Add 25kg and repeat.
 Clearance looks good! With weight on, need to make sure rails on foam blocks align as enter PST. PST rail slightly dinged at entrance. Ready for panels but first have to get cans on.

Re-assembling A3-4. Put on upright stand. See pictures below. This is tricky.



Continuity testing held up because fibers in the service panel slots are in the way of getting at bolt head at two of three spots. The fiber folks worked on this but it's a pain. Need to think about revised sequence.

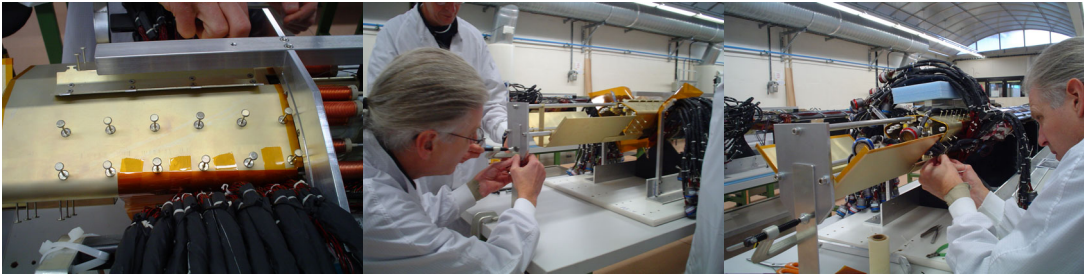
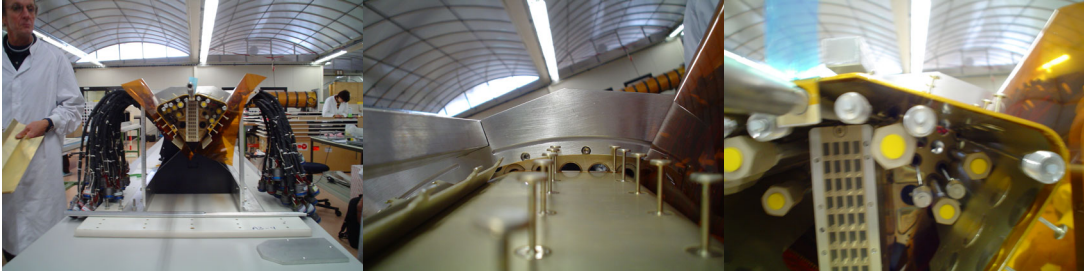
Continuity was completed by J-F and Tobi. ISP with opto could not be done. Opto connector interferes with heat spreader by about 1/8". Could be modified, maybe. No problems seen by them – amazing given work done on this unit.

November 10, 2006

Took ½ weight off of BPSS. Weight to simulate frame was already removed yesterday – foam digging into cruciform. Took apart cans, buckets, rods. Next step is to install can-bucket-rods on A3-4 and figure out how this works. Rodney, Ahmet and Kurt working on this and developing written procedure. In parallel, need to put fibers on bottom of A1-2 OSPs. It's on the inverted stand. Picture here for the record before starting fiber loading.

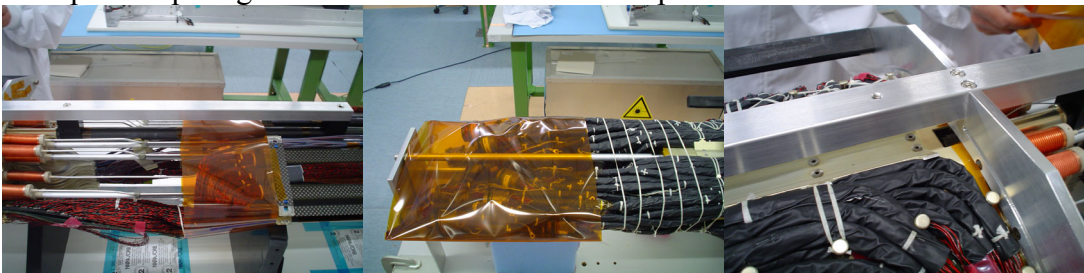


Bending of wires on A3 is illustrated below.



November 11, 2006

Preparing A3-4 to put on BPSS. Kapton around bucket to keep connectors in in tilted position. **Note that hole to get to trantorque is too small.** Could not loosen so will loosen cruciform for this one and then make sure A1-2 is set before putting on wires. Also put a kapton girdle around interior wires. See pictures below.

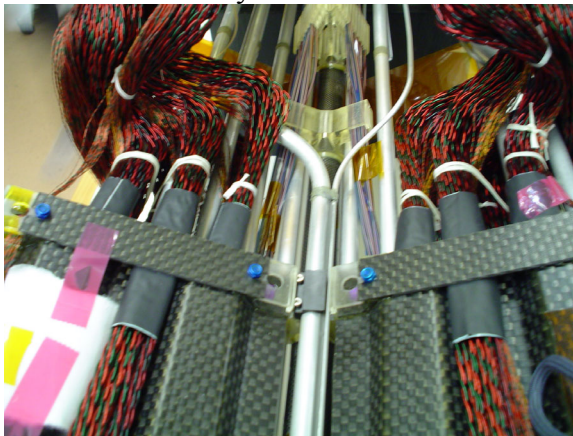


Did a trial lift from upright stand. OK but transfer of bucket support to rider plate is going to be really tricky. Decided to try to make bar to extend over bucket – extend backbone-backbone such that bucket and quarter plate are rigidly connected by backbone-backbone. Trying to scrounge parts on a Saturday. Also may have to make something to torque the PP0 end for this test. In real case the insertion of SQP onto BPSS is vertical but not in this test. Trying to modify some scrap parts we found. Backbone-backbone was extended to grab the end of the bucket.

Tried to put A3-4 on BPSS. There are a number of areas of interference and in the end we removed it to try to fix these. The fit of the ISP brackets at the PP0 end is too tight. The relief of the BPSS ends needs to be rounded to conform to the button head screws and not be a sharp angle. The end of the ISP PCBs need to be rounded off. The major interference is with the wire bundles from the ISP as they pass over the cruciform closest to PP1. They are not flat and raise up the assembly by a few mm. Too risky to force inward and capture with just bolts in the SLA. Need to put kapton on cruciform edges. The alignment of the threaded holes on the longerons is OK in most spots but not all. Need to slightly open up the through holes in the SQP structure to not force screws next time. A few pictures below, many more in November 11, 2006 folder. The difficulty at the cruciform is because the wire bundle moves into the cruciform edge plane. The solution is to bend strongly away. There seems to be plenty of clearance radially for the ISP wires. Some of the ENV need to be routed properly, they do not conform to the other wires and are hanging out.



It appears that we can simply solved the “bulging wire” problem on the ISPs at the composite cruciform by tying the ISP wires to the OSP wires at this location. This pulls the ISP out radially and OSP wires in radially. We did this. See below.



The holes in the SLA on the SQP were opened up slightly. Some filing of the PP0 boards and around the button heads on the BPSS. Put A3-4 back up to BPSS and finally made it fit. Since loading is not vertical wants to slide down just a bit making easy engagement of bolts on SLA at bottom hard. But still we managed to tighten all but one and could engage that one.

Inserted into PST using kapton sheet at the very tight spots, namely the cable bundle at a few spots. All else did not require these shoehorns. Ran in and ran in reverse. Proof of principle that it can be done!!! Many pictures are in November 11, 2006 folder. Only three here.



November 13, 2006

Fibers on A1-2 OSP bottom not completely loaded over weekend so we are dead in the water until this is done.

Fibers were completed. Smart shim of ISPs. Modifying and taping can. ISPs put on A1-2 and put on upright stand.

A1-2 tested. A1, OSP, Module 1 Top VDD sense supply open. All else OK.

Canning. Here is what we did although this may not be applicable to final production

1. Trial screw rods into quarter plate (we did not do this!). Had to grease threads on top rods.
2. Pull Al nuts on inlets to end of inlets
3. Transfer blue sleeves to go behind nuts to hold them
4. Visual inspection of inlets and outlets.
5. Tape off fiber connector.
6. Remove upright vertical arms (if there)
7. Add kapton sheets as necessary to cover desired area.
8. Install top rod in can first and tighten nut
9. Insert can with people on each side watching clearance, which is REALLY tight. Exhaust tubes on sides are VERY tight – scary!
10. Install other two rods.
11. Make sure can corners are all the way in and that clearance to buttons (to bottom of machined arc) look OK
12. Install bucket and support plate and support of bucket
13. Pull kapton down on sides and tape to can
14. Start bending – see picture folder and Excel spreadsheet. Scary

We finished bending on A1. Pictures in the Nov13Pics folder.

November 14, 2006

Bent wires on A2. Order is different than A1. Order is captured in a spreadsheet on the Trial Insertion wiki page. The order is reproduced below.

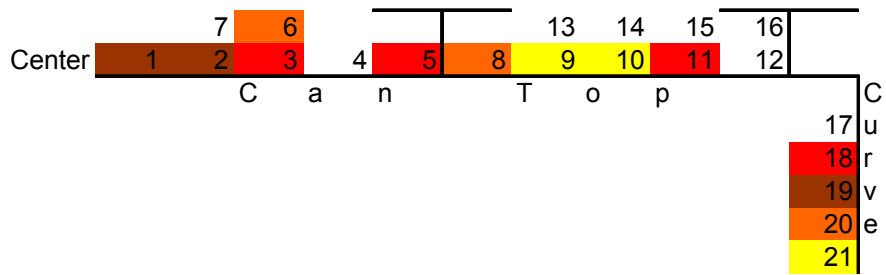
STEP

A1

1	ISP	Purple	L-Connector 1	INTC1
2	ISP	Grey	L-Connector 2	INTC1
3	ISP	ENV	L-Connector 2	INTC2
4	ISP	Black	L-Connector 1	INTC2
5	ISP	Black	LConnector 2	IPS3
6	ISP	Purple/Grey	L-Connector	IHV1
7	ISP	Black	L-Connector 1	IPS3
8	ISP	Black	L-Connector 1	IHV2
9	ISP	Grey	L-Connector 2	IPS2
10	ISP	Grey	L-Connector 1	IPS2
11	ISP	Purple	L-Connector 2	IPS1
12	ISP	Purple	L-Connector 1	IPS1
1	OSP	Brown	L-Connector 1	OPS1
2	OSP	Brown	L-Connector 2	OPS1
3	OSP	Red	L-Connector 2	OPS2
4	OSP	Bleu/Green	L-Connector	OHV3
5	OSP	Red	L-Connector 1	OPS2
6	OSP	Orange	L-Connector 2	OPS3
7	OSP	Red/Yellow	L-Connector	OHV2
8	OSP	Orange	L-Connector 1	OPS3
9	OSP	Yellow	L-Connector 1	OPS4
10	OSP	Yellow	L-Connector 2	OPS4
11	OSP	Red	L-Connector	OHV1
12	OSP	Green	L-Connector 1	OPS5
13	OSP	Green	L-Connector 2	OPS5
14	OSP	Blue	L-Connector 2	ONTC3
15	OSP	Blue	L-Connector 2	OPS6
16	OSP	Blue	L-Connector 1	OPS6
17	OSP	Green	L-Connector 1	ONTC3
18	OSP	Red	L-Connector 2	ONTC1
19	OSP	Brown	L-Connector	ONTC1
20	OSP	Orange	L-Connector 1	ONTC2
21	OSP	Yellow	L-Connector 2	ONTC2

and the diagram for A1

C	9	12
a	8	11
n	7	10
S	3	6
i	2	5
d	1	4
e		



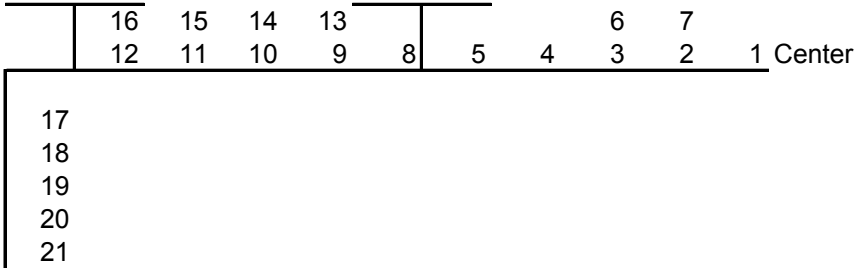
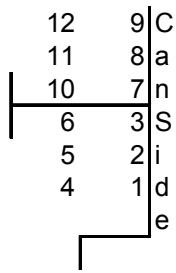
And for A2

STEP

A2

1	ISP	Purple	R-Connector 1	INTC1
2	ISP	Grey	R-Connector 2	INTC1
3	ISP	ENV	R-Connector 2	INTC2
4	ISP	Black	R-Connector 1	INTC2
5	ISP	Black	R-Connector 2	IPS3
6	ISP	Purple/Grey	R-Connector	IHV1
7	ISP	Black	R-Connector 1	IPS3
8	ISP	Black	R-Connector 1	IHV2
9	ISP	Grey	R-Connector 2	IPS2
10	ISP	Grey	R-Connector 1	IPS2
11	ISP	Purple	R-Connector 2	IPS1
12	ISP	Purple	R-Connector 1	IPS1
1	OSP	Brown	R-Connector 2	OPS1
2	OSP	Brown	R-Connector 1	OPS1
3	OSP	Red	R-Connector 2	OPS2
4	OSP	Red	R-Connector 1	OPS2
5	OSP	Blue/Green	R-Connector	OHV3
6	OSP	Orange	R-Connector 2	OPS3
7	OSP	Red/Yellow	R-Connector	OHV2
8	OSP	Orange	R-Connector 1	OPS3
9	OSP	Yellow	R-Connector 1	OPS4
10	OSP	Yellow	R-Connector 2	OPS4
11	OSP	Green	R-Connector 1	OPS5
12	OSP	Red	R-Connector	OHV1
13	OSP	Green	R-Connector 2	OPS5
14	OSP	Blue	R-Connector 2	OPS6
15	OSP	Blue	R-Connector 1	OPS6
16	OSP	Orange	R-Connector 1	ONTC2
17	OSP	Green	R-Connector 1	ONTC3
18	OSP	Blue	R-Connector 2	ONTC3
19	OSP	Yellow	R-Connector 2	ONTC2
20	OSP	Red	R-Connector 2	ONTC1
21	OSP	Brown	R-Connector	ONTC1

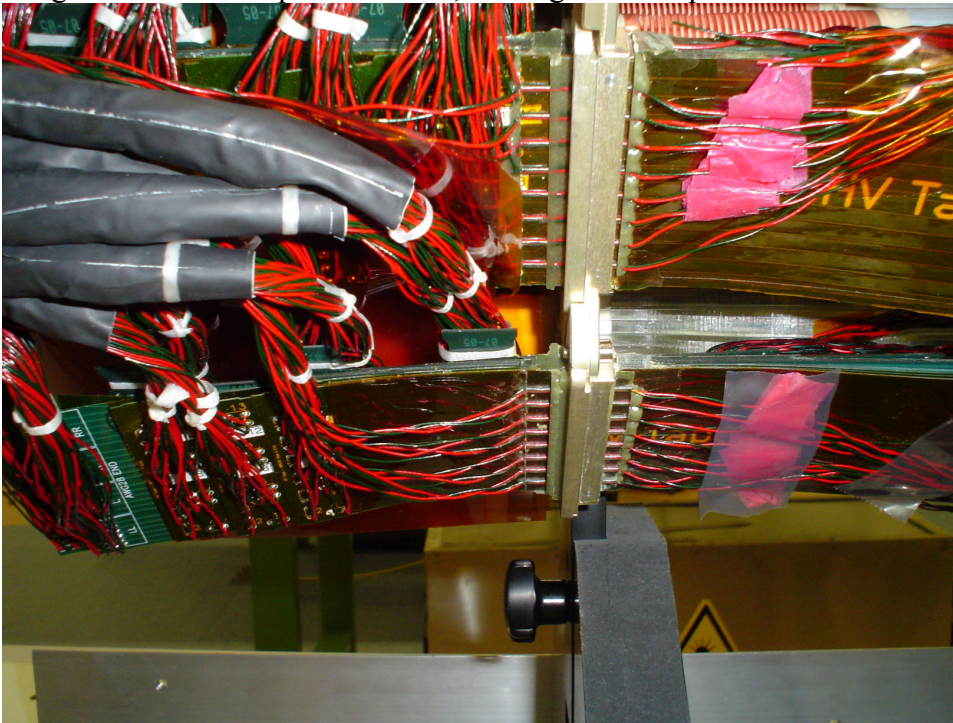
and diagram



Arrange connectors in bucket and wrap with kapton. Rearrange spare wires, add kapton... ready to go.

November 15, 2006

A1-2 is dressed and ready to put on BPSS. Try to put it on. Cannot fully engage quarter plate – interference at flange. Took off and put back on upright stand. Problem with flange can be seen in picture below, although for this picture bolts had been loosened.



ISP flange bolts removed and flange dropped about inch. Slide back OSP. Epoxy flash. Removed. Put back flanges. OK. Lift up and insert into BPSS! The corner nearest center of ISP A2 is not properly notched and the slot in the tab is not full width. This made this go up by about 1mm, could not engage screw – see below.



Keep going and insert. Clearance OK! Better on this side because of revised wire bending pattern by a little bit. Lots of pictures in Nov15Pics and just one here for fun.



Inserted both directions. Pictures etc. Congratulations all around....

Take off A1-2. Front tab on A1 near center delaminated, has to be reglued. Removed A3-4 from BPSS. Took BPSS off rails.

THE END