FDIRC prototype status and an update on tasks & schedule

J. Va'vra

SuperB collaboration meeting in London, 2011

Content

- Status of optics.
- Status of Fbox & CRT mechanics
- Status of detector preparation for the CRT test.
- Update on FDIRC R&D tasks & schedule

FDIRC: Definitions of names

(For newcomers)

Photon camera optics:



Fhoton camera mechanics:



FBLOCK and New Wedge

J. Va'vra

- Polishing of the new Wedge is finished. It is being delivered to SLAC.
- FBLOCK polishing will be finished by the end of September. Then it will go to the plating company to produce two mirror surfaces. We will get it sometimes in October.
- The shape of the new optical pieces will be beasured with a digital arm owned by the alignment group at SLAC.

FBLOCK after machining its shape:



FBLOCK on x-y polishing table:





Massimo Benettoni, Nicola Mazziotta, and technicians from Padova & Bari



• Padova and Bari technicians did a very good work.

Fbox support in CRT

Massimo Benettoni, Nicola Mazziotta, and technicians from Padova & Bari



• The parts were shipped to SLAC.

Mechanical trial test of Fbox in CRT

M. McCulloch and J. Va'vra









- Fbox and its support was sucessfully trial fitted into the CRT stand.
- Right now we working detector holder, electronics shield, air cooling, cable entry.

Test of bar box - wedge gluing



M. McCulloch and J. Va'vra

Gluing fixture:



Trial test of large area gluing:



- Matt has made a fixture allowing to glue the new Wedge to the bar box window. In a trial test we used a float glass to simulate the coupling.
- Gluing procedure has been worked out and works well. <u>No bubbles</u>.
- Use Epotek 301-2 for this coupling.

Caught an error in the wedge height

J. Va'vra and M. McCulloch

Correccted design:





- Error was caused by an <u>incorrect bar box window thickness</u>, which I used in the original optical design.
- It was caught by trying to check the alignment with the dummy Wedge, which then led to several subsequent benchtop optical measurements.
- <u>This was corrected without any loss of time or additional cost, as Cosmo</u> <u>could easily incorporate this change as polishing was not yet finished</u>.

O-ring candidates

M. McCulloch, J. Va'vra

O-ring in FBLOCK:



O-ring made of Silicone:



O-ring made of Viton tube:



O-ring casted from RTV:



- Initial design had solid Viton O-ring.
- We worried about a force it can exercise on the FBLOCK tip.
- The Viton tube O-ring tube with thin walls seems to be the best choice.

FDIRC prototype detector layout

J.Va'vra



- Gary has increased a footprint of his BLAB3 package, and as a consequence, I had to reshuffle the detector spacing to accommodate it.
- We will have 12 H-8500 tubes for BLAB3 electronics, 1 tube for the analog monitoring, and 11 tubes for the LAL electronics. Right now we have 15 tubes, so we would have to buy 8 more tubes. Altogether there will be 24 H-8500 tubes.

Go-no-go fixture

Remaining major items

- Measure dimensions of theNew Wedge
- Glue the New Wedge to bar box window
- Instal the barbox into CRT
- Measure dimensions of the FBLOCK
- Disassemble Fbox, clean its parts
- Assemble the FBLOCK into Fbox.
- Install Fbox into CRT.
- Make a glue connection between the FBLOCK and Wedge with RTV.
- Light seal the Fbox
- Instal detectors and electronics, cooling, cables, laser calibration, etc.
- Start the running.



- The scattered light does depend on gluing orientation.
- Decided not to glue it, but simply press the OPAL diffuser against the block. In this way it is also removable, if we will not be happy with it.

Transmission = f(radiation dose) up to ~250krads



- Transmission measurements were done at SLAC and at the end finished in Glasgow, as our monochromator failed. My friend, Matthias Hoeck, helped me to finish it.
- Bottom line: Corning 7980 Fused Silica and RTVs are OK, Epotek-302-1 is the worst.

Compare gain in two corner pixels





• Higher efficiency of pixel 64 is due to higher gain in that corner of PMT.

Add a new hodoscope to define the spot

J. Va'vra

16 square fibers (2 mm x 2 mm) in x&y directions and readout by H-8500 MaPMT:





- This hodoscope we built with Matt for the ESA beam test. Now we have installed it into the CRT setup to define the spot more preciselly (for some tracks).
- Fibers are readout by an H-8500 tube.
- The 1-st test indicates that the CRT tracking resolution is: $\sigma \sim 5.5$ -6.5 mm.
- This hodoscope will define the spot to less than a 1 mm.

Status of FDIRC tasks

\diamond	A	В	C	D	E	F	G	н
1	Tasks for FDIRC prototype test in CRT	Present list of institutions	People	Time to start	Time to finish	Range [days]	Comment	Critical items
2	I. FDIRC optics:							at present
3	a) Mechanical support structures			ll accord al				
4	Mechanical design of Fbox	Padova, SLAC, Bari	MB, JV, NM, MMcC	15-Jan-11	5-May-11	110	finished	
5	Machining of Fbox parts	Bari & Padova	MB, NM	5-May-11	5-Jun-11	31	finished	
6	Mechanical design of Fbox support in CRT	Bari, Padova, SLAC	NM, MB, JV, MMcC	15-Jan-11	5-May-11	110	finished	
7	Machining of Fbox support for CRT	Bari & Padova	MB, NM	5-May-11	30-Jul-11	86	finished	
8	3D dummy model of the New wedge & FBLOCK	Bari, Padova, SLAC	MB, NM	1-Mar-11	25-Jul-11	146	finished	
9	Careful chemical cleaning (etching) of Fbox parts	Bari & Padova	MB, NM	1-Jun-11	10-Aug-11	70	finished	
10	Trial assembly of Fbox & 3D dummy, possible modifications, itterate	Bari & Padova	MB, NM	10-Jun-11	15-Aug-11	66	finished	
11	Sending Fbox, support and 3D dummy model to SLAC	Bari & Padova	MB, NM	15-Jul-11	20-Aug-11	36	finished	
12	Trial assembly of Fbox at SLAC, possible modification, itterate	SLAC	MMcC, JV	25-Jul-11	15-Sep-11	52	finished	
13	b) Quartz optics (FBLOCK, New Wedge, coupons)		MB, NM					
14	Optical design (ray tracing) and verification by MC	SLAC, Maryland	JV, DR		15-Jan-11		finished	
15	Raw quartz material procurement and delivery	SLAC	Corning, JV	15-0ct-10	10-Jan-11	87	finished	
16	Quartz machining & polishing & plating of FBLOCK & New Wedge	SLAC	Cosmo optics, JV	25-Mar-11	15-Aug-11	143	in progress	
17	Delivery of the New Wedge to SLAC	Cosmo	Fedex	5-Jul-11	15-Jul-11	10	in progress	
18	QC of New Wedge at SLAC; compare them with Cosmo data	SLAC	QC, MMcC, JV, MC	1-Jul-11	5-Sep-11	66		
19	Glue the New Wedge to bar box	SLAC	MMcC, JV	5-Jul-11	15-Sep-11	72		
20	Delivery of FBLOCK to SLAC	Cosmo	Fedex	12-012-012-0-2-5	15-0ct-11			
21	Mechanical QC of FBLOCK at SLAC; compare them with Cosmo data	SLAC	QC, MMcC, JV, MC	15-Aug-11	20-0ct-11	66		
22	Simple optical tests of FBLOCK with a laser (look for lobes, etc.)	SLAC	JV.	20-Aug-11	21-0ct-11	62		
23	Glue laser light diffuser to the bottom of the FBLOCK	SLAC	MMcC, JV	21-Aug-11	22-0ct-11	62		
24	Assembly of Fbox around FBLOCK & New Wedge	SLAC, Bari, Padova	MMcC, JV, MB, NM	22-Aug-11	25-0ct-11	64		
25	FBLOCK & Fbox assembly finished in the clean room	SLAC	MMcC, JV	25-Aug-11	28-0ct-11	64		
26	c) Final integration in CRT			10 ST 1				-
27	Removal of the present FDIRC prototype from CRT	SLAC	MMcC, riggers, JV	0	17-May-10		finished	
28	Installation of bar box support base for the new bar box	SLAC	MMcC, riggers, JV		20-May-10		finished	
29	QC the bar box base before bringing the bar box	SLAC	MMcC, alignment, JV		30-May-10		finished	
30	Install the bar box #0 on the CRT base	SLAC	MMcC, riggers, JV		18-0ct-11			
31	Install the Fbox support to the CRT base	SLAC, Bari, Padova	MMcC, JV, MB, NM		5-Sep-11		finished	
32	Trial fit of Fbox & dummy & bar box in CRT - adjust alignment	SLAC, Padova, Bari	MMcC, MB, JV, NM		30-Jun-11			
33	Bring Fbox with the real FBLOCK & New Wedge to CRT	SLAC, Padova, Bari	MMcC, riggers, JV, NM		25-0ct-11			
34	Optical coupling between the FBLOCK & New Wedge (RTV ?)	SLAC, Padova, Bari	MMcC, JV, MB, NM		31-Jan-12			
35	Gas sealing of Fbox and bar box, install the N2 boil-off gas flow	SLAC	MMcC		5-Aug-11			
36	Install the N2 boil-off gas flow	SLAC	MMcC		7-Jan-12			
37	Install the mechanical enclosure and establish the light seal	SLAC	MMcC, JV		12-Jan-12			
38	Install detectors with their initial electronics - see more later	SLAC, Hawaii	GV, JV, KN		15-Jan-12			
39	d) Other tests/actions which need to be done relatively soon							
40	R&D on optical coupling between large area glass surfaces (Epotek & RTV)	SLAC	MMcC, JV				finished	
41	Make a diffuser for the laser calibration, and test it	SLAC	MMcC, JV				finished	
42	Order mirror coupons from the plating company	SLAC	JV				finished	
43	Evaluation of mirror coupons for FBLOCK coating - hardness tests	SLAC	MMcC				finished	
44	Evaluation of mirror coupons for FBLOCK coating - radiation sensitivity	SLAC	VL					
45	Evaluation of several diffusers for laser calibration	SLAC	VL				in progress	
46	Find a new place to do optical transmission tests with a spectrophotometer	SLAC	٧L				finished	13
47	Create a glue test samples for "yellowing & radiation" tests	SLAC	MMcC, JV				finished	
48	UV light exposure of glue samples	SLAC	٧L					
49	Radiation tests of glue samples	SLAC	٧t				finished	
50	Tests of optical coupling between detectors and FBLOCK (Grease ? RTV ?)	SLAC, Padova, Bari	MMcC, JV, MB, NM				finished	
51	Measure refraction index of RTV used for coupling between Wedge & FBLOCK							
52	Optical distortions in RTV coupling between Wedge and FBLOCK							
53	Measure various distortions and errors in the FDIRC prototype	SLAC	alignment, MMcC, JV					

Fair amount of work was actually done, but we are not there yet.

Status of FDIRC tasks

0	A	В	C	D	E	F	G	н
54				1				
55	Tasks for FDIRC prototype test in CRT	Present list of institutions	People	Time to start	Time to finish	Range [days]	Comment	Critical items
56	II. Detector installation:							atpresent
57	a) Plan for the 2011:							and the second of the second of
58	Design of a temporary detector patern on a focal plane	SLAC, Maryland, Hawaii	IV. DB. GV	6	15-Sep-11		in progress	
59	Make a temporary detector & electronics G-10 holder design for 14 detectors	SLAC	MMcC		15-Sep-11		in progress	
60	Temporary HV power supplies and HV distribution for 14 detectors	SLAC	IV.		15-Aug-11	-	finished	-
61	Temperaty H) (collect and fiber for 14 detectors for initial testing	SLAC	Dr		20-Aug-11	20212	in prograss	
62	b) Disp for the 2012 -	ODAG			20 Adg 11	07010	in progress	
63	Final motherheard development for 49 detectors (resp. 9v6 detectors)	LAL Badous Bari SLAC	CR					
64	Final moderboard development for 46 detectors (resp. 6x6 detectors)	Dadoup Bari LAL SLAC	MB NM MM-C DC					
65	Final Medianics to hold the moderboard on the FBLOCKY FBOX	Padova, Ban, DAC, SDAG	MB, HM, MMCC, SV					
66	Final AV power supplies and AV distribution							
67	Trailude ether persible detertors is serve slate (for everyle (2,400 a 2)	Dedewe	00				-	-
60	Include other possible detectors in spare slots (for example d-APDs ?)	Padova	45					
00	The second se							
09	111. Electronics installation:						-	
70	a) Plan for the 2011:							-
/1	BLAB3 electronics	Hawaii	GV, KN		15-Jan-12		in progress	
12	Install BLAB3 modules, fiber connections,	SLAC, Hawaii	MMcC, JV, GV, KN		15-Jan-12			
73	Temporary electronics cooling	SLAC, Hawaii	MMcC, JV, GV		20-0ct-11			
74	Initial debugging of FDIRC operation	Hawaii, SLAC	GV, KN, JV		30-Nov-11			
75	First attempt to take data	Hawaii, SLAC	GV, KN, JV		15-Feb-12			
76	t0 time for CRT telescope using Start Quartz counter	SLAC	JV				finished	
77	b) Plan for the 2012:							
78	Final motherboard	LAL, Padova	CB, MB					
79	Final TDC/ADC electronics available in 2012	LAL	CB, HL, VT, DB					
80	Install the electronics	LAL	CB, HL, VT, DB					
81	Final mechanics of the electronics cooling	LAL, Padova, Bari, SLAC	CB, MB, NM, MMcC, JV					
82	Initial debugging of FDIRC operation	LAL	CB, HL, VT, DB					
83	First attempt to take data	LAL, SLAC						
84								
85	IV. Characterization of H-8500 detectors:							
86	a) Scanning setups:							
87	Scanning setup hardware and associated software development	Trieste ??	?				plan	
88	Scanning setup hardware and associated software development	Bari	NM,FG, FG				in progress	
89	Scanning setup hardware and associated software development	Maryland	DR,				in progress	
90	Scanning setup hardware and associated software development	SLAC, Hawaii	KN, JV, DA			0	in progress	
91	Topics to study in the scanning setup:							
92	A simple measurement of the 2D efficiency normalized to Quantacon PMT	SLAC, Hawaii	KN, JV, DA				finished	
93	Detailed measurement of the 2D efficiency mormalized to Quantacon PMT							
94	Measurement of the 2D TTS resolutions							
95	Measurement of single pe spectra in center of each pad							
96	Measurement of cross-talk							
97	Charge sharing between pads and its use to improve the resolution							
98	Performance of the final electronics on the detectors							
99	Search for problems in detectors and electronics							
100	b) Other special setups or problems to solve:							
101	Rate effects of H-8500 tubes	Novosibirsk						
102	Cathode aging effects of H-8500 tubes	Novosibirsk						
103	Radiation damage of the electronics							
104	Magnetic field sensitivity of H-8500 tubes							
105	Design of a pecessary magnetic shielding for H-8500							
105	Design of a background shielding for FBLOCK, H-8500 and its electronics							
107	tO time: its origin and its distribution within SuperB							
109	Sustematic study of due scattering at large incident angles					-	-	
	systematic state of glue stattening at large inductivalities							

A critical will be soon: <u>Electronics</u>