

## Patch Box Status and Progress

Pete Shield  
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### Introduction

The progress on the design of the Patch Boxes has been rather slow due to several reasons but mainly because of unknown cable and connectors to be used between the PB's and veto wall electronics. This has now started to be resolved and this is a statement as to what has to be done, what decisions need to be made, who is the component contact and time scales. A component is defined as the group responsible for an input to the Patch Box.

First of all is the general overall time scales. In order to do any testing of the MVD in the Jade Hall one or more of the PB's must be available and as complete as possible to allow interfacing to the MVD Ladders and Wheels. I am therefore planning and scheduling the work to provide :-

*1 x Prototype Patch Box ready in the Jade Hall by the end of Sept 00*  
*4 x Production PB's ready by the end of Nov 00*

As you will be aware, this is only 20 weeks away and we are approaching the holiday season. It is therefore essential that we get the design finished asap and start building the first prototype. This is going to be difficult as it requires detailed knowledge of all the cables and connectors to be used as of now, to ensure that it will all fit and is practical. I therefore request that decisions and agreements be made as soon as possible and that components will provide details on connectors and cable when requested. I will be sending out documentation to each of the components involved on the layout of their module and progress in development, and will require verification and acceptance as and when necessary.

Many people may not be aware to what the Patch Box consists of, therefore I will start with a brief outline of the conceptual design. I have made some assumptions and decisions already based on verbal discussions at MVD PB meetings, if you disagree with me or have any concerns or suggestions please let me know.

### Conceptual Design

- There are 4 Patch Boxes which are necessary to interface the 206 combo cables coming from the MVD into larger cables going to the read-out and control electronics in the racks by the veto wall and rucksack. The Patch Boxes are labelled A,B,C&D starting from the top left and rotating clockwise when viewed looking into the Interaction Region from the Cryo support frame. It is essential to keep the combo cable lengths as short as possible to prevent loss of performance and therefore the PB's will sit in the 1.5M x 1.5M aperture inside of the BAC which is the closest practical position. This therefore has put constraints on the size of the PB's and has forced decisions on the design before all information was available on the size of cables and connectors, and method of screening was fully understood. It is now necessary to make it fit in the specified position.
- A PB consists of a Schroff housing which will be mechanically attached to the magnet support frame and therefore connected to the main detector ground. An inner EMC screened 6U x 21 slot (only 20 slots will be used) standard chassis will fit into this housing BUT will be electrically isolated and therefore form the 'Faraday Cage' for the interface modules. (*Photo PB#1*)
- The combo cables enter the crate from the side (nearest to the MVD) via 12 'Combo Ports'. (*Photo PB#2*) One of these ports is allocated to the radiation monitor cables and the rest accept 11 bundles of zipper tubes containing the 51 or 52 combo cable depending on which crate.  
Ref ([http://www-zeus.desy.de/~wiggers/cable\\_show.html](http://www-zeus.desy.de/~wiggers/cable_show.html))  
The zipper tubes will slide over the split entry port tubes and be mechanically held with cable ties. The braids will connect outside of the 'Combo ports' via a terminal to the clean/chassis ground.

- ❑ The combo cables need to have the maximum length of zipper tube right up to the shortest cable in the bunch. The zipper will then be cut back to the appropriate length during installation to give the minimum length of cable to be lost inside the crate. Variations in the length of these cables must be lost in the space behind the PB combo connectors and due to restricted space must be as short as possible.
- ❑ The terminators on the end of the combo cables plug horizontally onto the rear of 5 x DIN 41612 connectors with 13mm length pins forming a plug for the socket on the terminator card. 10 combos terminate on each of the P1, P2 DIN connectors thus giving 20 channels in each vertical slot. (*Drwg-Combo Term*)
- ❑ The slots and modules are numbered from left to right when viewing from the front of the crate. The slots are allocated as follows :-

Slots:-	1, 7, 13	Analogue Modules
	2, 8, 14	HV Modules
	3, 9, 15	Clock Modules
	4, 10, 16	Control Modules
	5, 11, 17	LV (a) Modules (Double width Module)
	6, 12, 18	LV (b)
	19,	Radiation Monitors
	20,	Spare
	21	Not Available

- ❑ Module designs are based around a standard 6U x 100mm VME size board (*Drwg-PB Card Dimensions*). Component module layout drawings will have their detailed layout drawings listed on the individual status sheets. The modules will not have front panels attached and all connectors must be pcb mounting. There will be plastic retaining clips attached to the guide rails to hold the pcb's in place.
- ❑ The output cables from the modules to the Veto Wall electronics exit the top or bottom front of the screened crate through special purpose module ports. (*Drwg-PB Cable Entry*) The module ports are 1 slot wide (20mm) and are clamped around the cables. Each module will require the cable braids stripped back the appropriate length, taken out of the ports and terminated with a bonding screw on the side of the port. These module ports will be assembled and suitably tied to the cables prior to assembly into the crate. There are 2 support rails, which the ports are screwed onto which form the main clean grounding to the rest of the screened crate. The 5 analogue cables are treated especially with zipper tube that terminates on the module port. A cable tie anchors the zipper onto a split tube to form the entry port. The braid will then be terminated with a bonding screw.

### Progress to date

There are many components to the Patch Box and progress is at various levels according to the complexity of the module and decisions been made and agreed. The status documents are therefore separated out in sections, which will be upgraded as progress evolves. Therefore it's recommended that interested parties maintain regular contact with their appropriate component of the patch box for changes to these status reports..

<u>Crate Status</u>	<u>Clock Status</u>	<u>Rad Monitor Status</u>
<u>Analogue Status</u>	<u>Control Status</u>	<u>Slow Control Status</u>
<u>HV Status</u>	<u>LV Status</u>	

<u>Crate Status</u>			
<b>Component Contact Person</b>		Pete Shield	p.shield1@physics.ox.ac.uk +44-(0)1865-273392 (Oxford)
<u>Date</u>	<u>Current Status</u>	<u>Drawing or photo references</u>	<u>Decisions Required by Component</u>
20/06/00	A prototype model is in the process of being built. An outer chassis with inner emc screened crate has been fitted with the necessary electrical isolation.	<i>Photo #1</i>	How is the crate fitted onto the magnet support frame ?
	The input ports for the Combo cables have been prototyped and 60 pseudo combo cable samples have been fitted, some with zipper tube to illustrate the terminating technique.	<i>Photo #3</i> <i>Photo #4</i>	How will the exposed entry port be protected from inadvertent grounding to the 'dirty ground'?
	One section of terminator modules has been assembled with combo cable routing in the rear of the crate.	<i>Photo #2</i>	Is there an elegant way to layer the excess combo cables?
	A section of the output module port has been constructed with some cables fitted, which represent the more difficult or demanding component entry ports.	<i>[Crate O/P ports].word</i> <i>Photo #5</i>	How will the exposed exit ports be protected from inadvertent grounding to the 'dirty ground'?

<u>Combo Terminator Status J00/012</u>				
Component Contact Person				
		Roberto Carlin	Roberto.carlin@pd.infn.it +49-40-8998-2908 (Desy) +89-49-827-7075 (Padova) <u>p.shield1@physics.ox.ac.uk</u> +44-(0)1865-273392 (Oxford)	<u>Decisions Required by Component</u>
		Pete Shield	<u>Drawing or photo references</u>	
<u>Date</u>	<u>Current Status</u>			
10/05/00	250 production pcb have been made and fitted with Samtec connectors. These have been bare board tested by the PCB manufacturer then subsequently tested for open or short circuits after assembly.	<i>[Combo Terminator].word</i> <i>[Combo silkscreen].ps</i> <i>[Combo layer1].ps</i> <i>[Combo layer2].ps</i> <i>[Combo layer3].ps</i> <i>[Combo layer4].ps</i> <i>[Combo layer5].ps</i> <i>[Combo layer6].ps</i> <i>[Combo solres].ps</i>		
24/05/00	230 of these boards were shipped to Axon in France complete with all fixing 'P' clips and screws for termination onto the combo cable.			
	<b>Combo Terminator Complete</b>			

<u>Analogue Module Status J00/065</u>				
<b>Component Contact Person</b>		Leo Wiggers	Wiggers@nikhmf.nl 020-5925058 (Nikhef)	
<u>Date</u>	<u>Current Status</u>	<u>Drawing or photo references</u>	<u>Decisions Required by Component</u>	
20/06/00	5 x Output Connectors RJ-45  Cable 5 x 7.7mm Dia. Cat 5 Enhanced (4x individually screened)  The net list for the 5 RJ-45 links to the P1/P2 connector and mechanical layout is complete.	<i>[Anal conn_rj45].jpeg</i>	Who are the manufacturers? We would like to maintain compatibility with the cable free plugs.	
	A 4-layer impedance matched pcb module has been routed and now ready to send out for production. The signal pairs are screened with an outer ground plane, local to the RJ-45 connector and additional ground tracks are routed between signals on signal layers to minimise cross-talk.	<i>[Anal Connections].word</i>		
28/06/00	Ground track changes made to signal layers as requested. Track dimensions and impedance's as defined by the board manufacturer:-  <p>Track Width 0.28mm Z Diff = 96.4Ω Z to GND = 57.9Ω</p>	<i>[Anal Schematic].ps</i> <i>[Anal layer silk].ps</i> <i>[Anal layer1].ps</i> <i>[Anal layer2].ps</i> <i>[Anal layer3].ps</i> <i>[Anal layer4].ps</i>	Require confirmation that this is ok to send off for production.	
			Second iteration now ready for acceptance.	

<b><u>HV Module Status J00/067</u></b>			
<b>Componet Contact Person</b>		Chris Youngman	<a href="mailto:Youngman@mail.desy.de">Youngman@mail.desy.de</a>
<b><u>Date</u></b>	<b><u>Current Status</u></b>	<b><u>Drawing or photo references</u></b>	<b><u>Decisions Required by Component</u></b>
12/05/00	Will use 10 screened cables each containing 4 coax Outer Dia 6.5 -> 7.0mm There will be 10 Subminiature 'D' connectors on the module, spaced out as 2 rows of 5		Waiting for the final decision on connectors and proposed layout.
22/06/00	Space is required for the temperature sensors. There are a total of 40 temperature sampling points on one analogue module. There will be a wiring patch section on the HV module to select only the appropriate channels required. These will then output onto a proposed 16 way IDC socket with a 8 pair twisted cable	<a href="http://www-zeus.desy.de/~wiggers/cable_show.html">http://www-zeus.desy.de/~wiggers/cable_show.html</a>	Need to know from Nikhef if a 16 way connector is adequate for temp sensor channels? Are we happy with an 8 pair screened cable up to the Veto Wall electronics?

<u>Clock Module Status J00/068</u>			
Component Contact Person		Gil Nixon	Gn@star.ucl.ac.uk 44-(0)20-7679-3901 (UCL)
<u>Date</u>	<u>Current Status</u>	<u>Drawing or photo references</u>	<u>Decisions Required by Component</u>
20/06/00	A block diagram and provisional layout exists with the connectors and cables defined. Schematic entry and board layout can proceed as soon as pin-outs of the connectors are defined.	<i>[Clk Drivers].word</i> <i>[Clk Layout].word</i> <i>[Clk Connections].word</i>	Urgent that we define the pin numbers to enable the pcb design to progress
28/06/00	Connector pin list received and Pcb Board layout started in the CAD office.		Need a decision on what to do with the twisted pair grounds for the Clk & Trg from the combo cables. Are they left open? decoupled to 0v with a capacitor? or tied directly to the common 0v plane? See <i>[Clk Drivers].word</i>

<u>Control Module Status J00/069</u>				
Component Contact Person		Gil Nixon Gn@star.ucl.ac.uk 44-(0)20-7679-3901 (UCL)		
<u>Date</u>	<u>Current Status</u>	<u>Drawing or photo references</u>	<u>Decisions Required by Component</u>	
20/06/00	A block diagram and provisional layout exists with the connectors and cables defined. Schematic entry and board layout can proceed as soon as pin-outs of the connectors are defined. A single channel layout of one of the 60 channels will start soon to confirm space criteria.	<i>[Cont Drivers].word</i> <i>[Cont Layout].word</i> <i>[Cont Connections].word</i>	Urgent that we define the pin numbers to enable the pcb design to progress	
30/06/00	Connector pin list received and Pcb Board layout started in the CAD office.		URGENT we need to know what amp should be used to replace the OPA623 (now obsolete) OPA 681 & OPA658 are replacements available is smaller chip size (SOT23)	



<b><u>LV Module Status J00/070</u></b>			
<b>Componet Contact Person</b>		Roberto Sacchi	<a href="mailto:sacchi@mail.desy.de">sacchi@mail.desy.de</a>
<b><u>Date</u></b>	<b><u>Current Status</u></b>	<b><u>Drawing or photo references</u></b>	<b><u>Decisions Required by Component</u></b>
30/05/00	2 x DB25 Power input connectors type Distrelec N 125737 2 x DB15 Sense input connectors type Distrelec N 125736		
1/06/00	Block layout drawing and connections netlist completed and pcb design started.	<i>[LV Layout].word</i> <i>[LV Connections].word</i>	
20/06/00	First iteration of pcb layout completed. This has turned out to be a most difficult board to route. The cross connections from the input connectors to P1 and P2 require a large number of via's. To keep the power tracks at an impedance comparable to the combo power cable cross section its anticipated that 10 layers will be required with the thickest Cu practical. Power tracks are 1mm wide, sense tracks 254um Need to speak to the board manufacturers to establish the thickest Cu available with 10 layers and an overall board thickness of 1.6mm.	<i>[LV layer1].ps</i> <i>[LV layer2].ps</i> <i>[LV layer3].ps</i> <i>[LV layer4].ps</i> <i>[LV layer5].ps</i> <i>[LV layer6].ps</i> <i>[LV layer7].ps</i> <i>[LV layer8].ps</i> <i>[LV layer9].ps</i> <i>[LV layer10].ps</i> <i>[LV silk].ps</i>	
	Need to establish a supplier for the connectors		

<u><b>Radiation Monitor Status</b></u>			
<b>Component Contact Person</b>		Flavio Dal Corso	Dalcorso@pd.infn.it 049-827-7201 (Padova)
<u><b>Date</b></u>	<u><b>Current Status</b></u>	<u><b>Drawing or photo references</b></u>	<u><b>Decisions Required by Component</b></u>
20/06/00	This is and active module which will be designed and built by Padova.		Need to know the rear input connector type asap. Need to know the output cable and connector types.