This guide is intended to help the ECAL HV experts on call.

Basic Practical Information

The HV expert telephone number is 165477. Normally there will be one main responsible on call and a helper. In case of need the helper should be called and assist the main responsible for heavy activities. During the week-end when there is a test-beam activity on-going, the person on-call should not go too far from the laboratory (it should be possible to react in less than half an hour in case of need).

How to operate a crate

You can find all the details about the crate operation in http://www.caen.it
The crates are SY1527. The boards are A1520P.
In this guide we suppose you are familiar with the basic operations that one can do from the keyboard when logged on the crate and via telnet.
In particular the reader should have read the SY1527 manual pages 45 and following pages.

Introduction

The ECAL Barrel is subdivided in 36 Super-Modules (SM). Each SM is made of 1700 crystals, divided in 17 groups of 100 crystals. Each crystal has two APDs glued on the rear face. The APDs are contained in a capsule.
On the rear part of the SM the electronics is mounted. The elementary unit of the read-out and trigger electronics is the Trigger Tower, constituted of a group of 25 crystals in a matrix of 5x5. One HV channel powers 2 Trigger Towers made of crystals of the same type. There are 34 HV channels per SM divided in 4 connectors at the patch panel.
Trigger Tower layout of a SM seen from the electronics side (back view) and the corresponding subdivision of the Trigger Tower in HV channels. Normally U1 is connected to Board0, U2 to Board2, U3 to Board4, U4 to Board6.
Calculation of the operating voltage

When the Super-Modules are built, the APDs are coupled in a capsule and the sorting mechanism works as follows. The APD gain-voltage curves are measured and the distribution of their working voltage for gain 50 is divided in bins of 5V. Within one bin the APDs are sorted so to have the APD with the highest available working voltage coupled in a capsule with the lowest available one. So the average gain of each pair of APDs is as much as possible at the average of the bin.

During the quality control and construction phase, the APDs are measured several times:

- at the Hamamatsu factory (but at a temperature of 25 degrees C),
- in the APD laboratory,
- in the Lyon laboratory, where the capsules are made, by a machine called Capucine,
- in the two regional centres (Rome and CERN), after gluing to the crystals, in a machine called Capucinette.

The Capucine measurements are intended to be the most precise measurements of the capsules and these voltage-gain curves are used to estimate the working voltage of a high voltage channel.

The Lyon laboratory gives values for the voltage corresponding to gain 40, 50, 60, 70 and 150 for all capsules plus the data of the measurements (usually indicated as Lyon40, Lyon50, etc.). It has been decided that the nominal working voltage for the ECAL Barrel be the Lyon50 settings.

When operating the SM for the cosmic calibration bench, a higher gain is required to optimize the signal to noise ratio for low cosmic ray signals. Thus a procedure has been put in place to fit the voltage-gain curves at high gain and calculate the operating voltage of gain 200.

Figure XX shows a fit to the voltage gain curves in the high gain range. Then the average working voltage is calculated for each channel.

These values are saved in the Database as V100, V150 and V200. The nominal operating voltage for cosmic ray calibration is at V200. This voltage is about 30V more than the Lyon_50 values.
The HV cabling outside the SM

The external cables are made internally of nine cables. Each of the 9 cables contains 4 wires: HV+, Sense+, HV-, Sense-. The sense line connects to the corresponding voltage line at the MotherBoards (at the Trigger Tower).
Each external cable has an extra pin that is connected to the cable shield and goes to the HV crate.
The shield of the connector itself on the patch panel side is grounded to the grid.
The shield of the connector on the Control Room side is floating.
The connector on the CMS side has female contacts and is made as in the Figure:

The connector on the Control Room side has male contacts and is made as in the Figure:

Each SM is powered by 4 cables, numbered U1, U2, U3, U4 and attached on the Patch Panel as in the Figure:
**Building 27 installation**

The assembly hall of B. 27 is 27-R007 in Meyrin site, near the entrance B. Francesca office is 27-R009 and a tool-box and other tools are available there. The keys can be asked in case of need to any person in the B.27 (Etienne Auffray and Antonio Conde have a passe-partout).

In Building 27 hall there are actually 3 crates for assisting the Mother Board mounting. Each stand is equipped with external cables of about 3 to 7 metres. One of these stands is actually going to power one SM with cooling and MotherBoards for a couple of months to test the MotherBoards for a long time. This stand is controlled by a PC with a labview program that logs to a file every now and then the currents drawn by each channel. The PC is called pccmsrm10 and is at the very end of the hall (27 R 002). The labview program can be found from the desktop, opening the folder “HV Control for SuperModule” and it is called test_mb_long.vi. The log file goes in the log directory of the same folder, in hvlog.txt.

In order to work properly, the HV crate must be connected to the network with the Ethernet cable, and the PC also.

To check that the connection is active, click on the start menu on the PC and look for the CAEN submenu → OPC server configurator. It should display the name of the crate, its TCP/IP number and OK.

If it says KO instead of OK, it means that the connection is not working. Check the cables or turn off/on the crate or the PC.

To check that the crate is connected to the network go to another PC and telnet crate_ip_number 1527. If it is responding, it means that it is a PC problem.

Another problem that may happen is that the logfile gets too big. Save it to another name and restart the labview.

To start the labview program open test_mb_long.vi double-clicking on its icon and, when it is opened, click on the arrow at the left top of the window.

To stop the program click on the stop button of the panel.

To display the behaviour of the currents and voltages in the last hour, select the channel number you are interested in, by typing the number in the appropriate “channel to display” window and look at the plots.

To see older data, look at the logfile.

The other crates in B.27 are available for the people mounting the motherboards. In case of problem with one of the cables go and get the cable tester in Francesca office 27-R009 and test the cable as described in the Section External Cable Test.

After the Mother-Boards are mounted, check that all is well connected by performing the Multi-meter test as described in the appropriate section.
**H4 installation**

The H4 area is in B. 887 at the end of the hall, towards Lausanne.
The code at the door is 70142.
The telephone is 76762 or 76761.
In H4 there are two crates, one is controlling the H4 cosmics installation and the other is controlling the H4 test-beam facility.
The H4 cosmics crate is named cmsechv12.
The H4 test-beam crate is named cmsechv02.
One can access both crates from the network via telnet cratename portname (where portname is 1527).
The crates both contain 4 boards and have independent interlock.
The crate for the cosmics bench is installed in the control room, entering from the door, it is almost at the end of the electronics room, on the right.
The crate of the test-beam line is in a rack together with the LV crates, just in front of the laser barrack. It is attached to a rooter that is connected to the H4 barrack network.

We have 1 screwdriver near the H4 cosmics crate in the control room and there is a toolbox in B. 867, see the 867 Section for details.
If you need to repair one cable, you should use the toolbox and if available call Sergio Guerra or Fabio in B. 867 to help you (tel. 71088).

Both crates are controlled by the PVSS program on the PC pcethdcs2 that is located in the H4 barrack, near the DAQ PCs. It is the last PC at the end on the table.
The Windows username and password are ecaldcs and password ZoneH4testbeam.
One can login remotely to the PC with vnc giving the command:
```
"vncviewer pcethdcs2" password: ZoneH4testbeam.
```
The program that controls the crates is written in PVSS.

**PVSS programs at H4/H2**

For PVSS to run properly one has to start the DNS on the PC (it is automatically starting at each reboot, it is a normal DOS window that appears, it should be iconized and not closed).
Then start PVSS from the Start menu, it is called PVSSII (see Fig.1).
When PVSS starts it shows the Project Administration window that allows to choose a given program.
The current program is ServiceProject (see Fig.2).
Click with the right-mouse button on the selected program and a scroll-menu appears.
Click on start Project.
A window appears called Console. Be patient, slowly the red lights on the window become green, a log window appears and another window appears called Device Editor and Navigator. Some rows may remain red, don’t worry (see Fig.3).
This is a very important window. It has many tabs (hardware view, logical view, FSM view). Click on FSM view. You will be shown a list of SuperModules (H4_BEAM, H4_COSM, H2 in the new program) (see Fig.4).
Click on the bottom button Start/Restart All. Wait until the “All domains starting”
disappears (see Fig.5).
Then click with the left-mouse button on one SM and then click with the right-mouse
button on the SM you want to see and a scroll-menu appears, click on View.
This shows the SM window.
On the top, right beside the SM status there is a lock. Normally this lock should be
closed for you to take control of the Super-Module. But at the beginning of the
program, the lock will be open. Click on the lock and a menu appears, click TAKE
(see Fig.6).
Now the Super-Module window is active, the VMon and Imon values are refreshed
and you have control of the Super-Module (see Fig.7).
If something does not work try the following:
1) close and restart PVSS
2) or reboot the PC and restart PVSS
3) call Georgi Leshev who is a PVSS expert

NOTE: when you are not planning to switch on and off the HV, leave it in the locked
status (grey). This avoids switching the HV on/off by mistake.

How to close PVSS
Close the SM panels if open.
Go on the Device Editor and Navigator Window and click on Stop All.
Close the window.
Go on the Console window and click on the small red traffic light at the top.
Wait until everything is red, except the process monitor row that will remain green.
Close the last active window that is the Console Window.
Go to the Project Administrator window and click on the icon with the two blue
arrows , this is a refresh of the list of active processes. Now everything should be Not
Running. Close this window also.
If something does not work you will probably have to press Ctrl-Alt-Del and kill the
program but it is very likely that it will not work when you restart it then. It is safer in
this case to reboot the PC.

How to change the HV
In the SuperModule panel of PVSS click on Expert Operations. A Panel appears with
many tabs (Fig.8).
In the new PVSS program (ServiceProject) you must first choose for which set you
want to change the voltages. Select the location you want to control (H4_BEAM,
H4_COSM or H2). A confirmation window will show up (Fig.9). Then choose the
SM number and then choose the setting you want (default normal running conditions
are at Lyon_50 for gain 50 and V200 for cosmics operation) (Fig.10). Click on
Configure. Once you click the voltages are sent immediately to the channels. DO
NOT CLOSE THE HV CONFIGURATION WINDOW FROM THE CLOSE. Firs
look at the logviewer and wait until you receive the message that the crate has been
configured. Only then Close the window.
NOTE: The HVSet are not automatically refreshed on the SM panel. You have to
close and reopen the SM panel to see the new settings.
There are voltages for all SM up to SM25.
Always check that the voltages you wanted to send to the crate are actually sent to the crate by checking one or two values in the files and in the crate window (with telnet or putty if you don’t want to go in front of the crate monitor).
FIG. 9

FIG. 10

You are about to apply the HV Settings for stand: **H4_COSM**

Choose SM Number for which you want to configure the stand:

SM18

Choose a HV Configuration Set. (Contact Francesca Cavallari in case of doubt):

VX00

Pressing Configure:

The configuration for the chosen supermodule will be loaded.
How to view the channel history

To view the channel history, open the SM panel as explained in the PVSS section. From the SM panel, double-click on the module where the channel you want to see is contained, then the module panel appears. Double-click on the channel number you are interested in. The channel panel appears. On the bottom you will see a chart. There are various variables plotted in the chart, the VMon, V0Set, IMon, I0Set. You can select which to visualize by clicking on the view tab.

Then there is the time menu. Click on the time menu to select the time extension you want to visualize.

You can have more complete options if you Freeze the plot. Remember to make it run when you are done so that it continues to refresh.

HV SCAN at H4-COSMICS

At H4 one has to perform regularly an HV scan, once per each SM installed. This operation requires that the SM is in normal running conditions since a while. So it should not be taken the very same day the SM is installed in H4 because it is not sufficiently termalized.

Inform the DAQ team that you are going to take a HV scan and that it will take 1 hour (Evgeni Vlassov, Paolo Rumerio, Giovanni Franzoni, Alessio Ghezzi and Reyes Alemany).

Check the actual settings of the voltages, they should be at “V200” (gain 200). Below you will find the details on how to operate the DAQ for these simple steps.

Take a pedestal and a laser run. (Normally the laser run is configured with the correct laser power to have about 2000 ADC counts at gain 200, this is perfect).

The pedestal run is called PEDESTAL-STD.xml and the Laser run is called LASER-STD.xml.

Then change the voltage settings to Lyon_50 (gain 50) and wait 15 minutes.

Take a pedestal and several laser runs (2 or 3).

Put back the settings at gain 200.

Wait 15 minutes and restart the cosmosics run (file ALL-TYPES.xml)

Here are the details on how to operate the run control to take a run.

Type: vncviewer pcminn11:1
if it is not yet opened.
This shows the DAQ control PC.

There should be a run control window opened.
Click on STOP if a run is already active and wait until it says run stopped.
Click Select Run Type
Choose the run you want from the list and click OK.
Wait until you get the message File opened and the button Start is active.

On the bottom of the run control you should see a list of sequences and cycles that are about to be done.

Click on Start.
The bottom window indicates the run progress.
When all is done you will get the message File closed.
In principle you can take a HV scan in your office opening the vncviewer to pcminn11 to control the DAQ and vncviewer to pcethdcs2 to control the HV. There is no need to go to H4, but you should inform the DAQ team and phone to the H4 control room before doing so (H4 telephone is 76762 or 76761).

**HV SCAN at H4-BEAM**

The first part of the previous section is valid here as well. The DAQ pc is pctorino1.cern.ch (instead of vncviewer use ssh as daq user and a browser to see the page http://pctorino1:40001/urn:xdaq-application:service=UI). The laser intensity file is /ecaldaq/etc/daq/ConfigurationDB_tb.xml; changes should not be necessary.

Having had the OK from DAQ people, on pctorino1 execute:
```
cd /ecaldaq
./stop.sh
./start.sh
```
(these commands are needed before each run)

then from the browser click on the "Autorefresh" button to abilitate the automatical updates of the page, choose the desired configuration from the "Run Configuration" menu (for the HV scan: PEDESTAL.H4 and LASER.H4), click the "Configure" button and wait until the ecal supervisor state is "Configured". Now click on the "Start" button. The ecal supervisor state will change to "Running". The status of the run can be checked from the url http://pctorino1.cern.ch/runstat.

See also the twiki page: Shift instructions for ECAL testbeams in H4

**P5 Installation**

P5 is located near Cessy, on the other side of the LHC ring with respect to Meyrin laboratory. You should be allowed to enter the gate if you have a valid CERN magnetic card. Once you enter the gate, you have to follow the route that goes to the left and after about 30-50 metres, before turning around the big building, you will see a green barrack on the right with some stairs. There is a panel just outside that says GREEN BARRACK. Enter the green barrack. You will find yourself in the control room. Go in the next room, you will see many racks. Our crates are in a rack in the last raw of racks on the left. There are two crates, one per SM installed in the magnet test. The SM are SM5 and SM13, and they are installed respectively in the location 6 and 7. The upper crate controls SM5 installed in location 6 and the bottom crate controls SM13 installed in location 7. There is one spare HV board in one of the crates.
**How to access the crates remotely**

The crates are in the P5 private network, they are inaccessible from outside. To login on the crates with telnet one needs to connect via the cmsdaquser0 machine that serves as gateway. From there you can telnet to the crates.

The crates are:
- **Cmsecalhv01**: IP: 172.16.112.3
- **Cmsecalhv02**: IP: 172.16.112.4
- Netmask 255.255.0.0

So in practice do the following:
- Login on lxplus with your afs account
- ssh cmsdaquser0
telnet 172.16.112.3 1527
to see the first crate or .4 for the second.
If you are not authorized to ssh cmsdaquser0 send an email to Eric Cano to get an account there.

**PVSS application at P5**

At P5 the crates are controlled via the PVSS application running on the PC ecaldcs02 at P5. This PC is physically located in the rack of the green barrack. It cannot be accessed directly with a keyboard and a screen.

One can login remotely via Remote Desktop Connection of Windows, or via vncviewer. This PC is visible both on the restricted P5 network and on the CERN network, so you can issue the vncviewer from pccmsrm14.

The PVSS program is very similar to the one of H4, but this comprises also the LV and cooling and ESS applications.

When opening a SM in the Device Editor and Navigator you will see a list of possible PVSS tasks and you should select HV for the Super-Module HV panel.

**How to change the HV at P5**

To change the HV go to the SuperModule panel and click on the Expert Operations button.

Then select the SM you want to operate on, and select the corresponding voltage setting and then click OK.

Note that no matter the SuperModule panel you started from, the settings will be given to the SM number you have chosen in the Expert Operation panel. This panel is in some sense unique for all SuperModules.

It has been decided that the magnet test settings are the V200 settings, so the SM will run at gain 200 to optimize the gain/noise ratio for low signals.
Building 867 is located in the Prevessin site. The telephone is 71088. There we have the electronics integration center. It is located in the area 867-R-F075, at the end of the 867 hall, on the Jura side, near the B. 904. Once you enter the big door, you will see a metallic door and then another door with a detector drawn. Enter the detector door. You will see that we have 3 crates there. 4 Sm can be controlled from that area, one Sm per crate plus another SM from the boards 5 6 7 8 of the first crate. (This extra stand is required to turn on a SM for few days when it is received and it is called stand 1-side). Stand 1 is the first on the left, then stand 2 is the one in the middle and stand 3 is at the end of the hall (the Italian electronics assembly line), see Figure. There is one tool-box in the second room on the left, Botjo Betev and Werner Lustermann know where the keys are. The toolbox is under the table at the end of the room on the left. In that same room we have a small crate that may be used for a fifth stand. There you may find a spare board. Inform Botjo Betev if you take it away.

How to change the HV at 867

To set the HV at B. 867 go to the PC that is normally on a table with wheels between stand 1 and stand 2. This is a PC reserved for DB operations at B. 867. Log in with your nice account if it is not yet logged in by someone else. There is a desktop icon for the HV programs. Open it and select the labview program called readfile_new.vi. Double click on the program to start it. Then select the stand you want to configure. Select the file name by clicking on the small icon right to the file name. Choose the file that is in the HVSettings folder and has the name with the corresponding SM number. Select the voltage settings you want.
Then click on the labview run program button (the top left arrow on the labview panel).
You will see in the message window that the program says configuring channel 1 etc..
At the end it will say if everything went well.
If a file is missing for some super-module, try looking at the following web address
http://cmsdoc.cern.ch/cms/ECAL/html/wp/hv/h4
or call Francesca.

Building 904 – Repository of the external cables
The External HV cables are stored in B. 904 on the roof of the barrack 904-U36, the off-detector electronics testing facility.
Enter the main door of B. 904 that is located on the back of the building (towards Lausanne). Turn left and climb the stairs.
We have 33 pallets of cables. There you may also find extra cable to produce both external and internal cables.
**Building 15**

Building 15 is our laboratory. The keys are the same as Rome office in B. 40. There we have two racks with the calibration and test setup plus all the crates and boards for CMS. In total we have 20 crates full of boards (18 are needed for CMS).

**Board Calibration**

Insert the board you want to calibrate in a crate SY1527 in one of the two calibration racks.

Then connect it with the red cable to the resistors set.

Switch the channel on at 380V. Wait for some time for the temperature to stabilize.

Turn on the calibration crate and connect the CAEN communication cable on the front of the SY1527 crate. Bypass the “localnet” input of the calibration crate with a resistor. Bypass the other input of the CAEN communication with a resistor. Both resistors should already be there.

Switch off the board you want to calibrate and connect the board with the black cable (the one made of many black wires) to the calibration crate and then turn the channel on again at 380V.

From the keyboard of the SY1527 login on the crate SY1527 as admin (password admin).

Switch on the calibration crate on the top of the rack.

Switch on the multimeter on top of the calibration crate.
On the keyboard of the crate go to the setup Menu
Go to HV Clock Config
Select ENABLE External CANBUS YES (select yes with the space bar of the keyboard).
Now the calibration crate appears as an extra slot in the channel list.
Turn on the board that you want to calibrate at 380 V.

Choose from the menu Setup -> Transparent Mode.
Select the slot you want to communicate = Board number.
A menu appears.
To have an extended menu type: “Ctrl [” from the keyboard, a more complete menu appears. Password is user.
Choose A for Automatic Calibration, then choose C for channel V-I calibration, then choose V for voltage calibration.
Enter Volmeter slot number (1).
Choose the channels you want to calibrate with a * (spacebar removes the *).
If you just type enter you select them all.
Then start the calibration.
A Voltage calibration for one board requires about 15 minutes, a V-I calibration requires 30-60 minutes.
When finished type Q to quit and Q again.
Then switch off the next board and change the cables and so on.

How to start the long stability test
Connect all the boards with the red cables to the resistor set. Turn on the rack, the crate and calibrate all the boards as described in the previous section.
Turn on the multimeter at the bottom of the crate.
Turn the switches of the resistors to be active.
Switch on all the channels at 380V. They should have a typical current of about 11mA. (3 slots should be installed in the front of the crate Sy1527, or it is not able to handle such power).
To start the long term test go to the PC and choose the program:
C:\Alex\HV_test\gdgfshsgf_18.vee
Choose from the Main window the crate you want to configure.
Make sure the directory exists in C:\hdgfshdg and the corresponding boards directories also exist or create them.
Write a text file in the CrateXX directory with the names of the boards under test.
Start the program by clicking on the left top black arrow.
The test will continue until when you press the black square stop button.
The test should last at least one month.
(INCOMPLETE I HAVE TO REVIEW THE DIRECTORIES).
The High Voltage Database: REDACLE_HV

The High Voltage Database is a new version of Redacle (CMS NOTE 2003/022) named REDACLE_HV; the homepage is: http://pccms06.roma1.infn.it/HV

Mysql server and web server are running on pccms06; this pc is located in Ed. Marconi, second floor, room 123/4 (tel +39064451642) close to the door.

The home page contains links to two groups of interfaces:

Database Query :

- **Find Parts**: this interface shows parts registered in the DB, their last activity and their superparts (e.g. the superpart of a board inserted in a crate is the crate itself).
  
  Part definitions:
  
<table>
<thead>
<tr>
<th>id</th>
<th>name</th>
<th>subtype</th>
<th>type</th>
<th>wfDefinition_id</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>crateSYM527</td>
<td>Barrel</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>supplyModule</td>
<td>Barrel</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
  
  - **See Composition**: given a crate barcode, it shows all the parts located in this crate, given a module/board barcode, it shows all the other parts located in the same crate.

  Characteristics definitions:
  
<table>
<thead>
<tr>
<th>id</th>
<th>description</th>
<th>name</th>
<th>unit</th>
<th>activityDef_id</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>positive variation w.r.t. the starting voltage (3 channels)</td>
<td>BINPOS</td>
<td>chanHV</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>negative variation w.r.t. the starting voltage (3 channels)</td>
<td>BINNEG</td>
<td>chanHV</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>difference between starting voltage and setting voltage (3 channels)</td>
<td>BINSET</td>
<td>chanHV</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>divoltage/temperature estimation (3 channels)</td>
<td>BINTEMPO</td>
<td>chanHV/deg</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>divoltage/linearization (3 channels)</td>
<td>BINLINE</td>
<td>chanHV/deg</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>reason to send back a part to DEP</td>
<td>RET_REMARK</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>move a module or a board into a crate</td>
<td>INSERT_PART</td>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>

- **Make a Generic Query on REDACLE HV**: this interface accept a generic query in sql syntax; some examples are provided.
For experts only:
(These interfaces are able to insert and change data in Redacle; a password is needed)

- **Move Crate Interface**: use this interface each time a crate is moved from one center to another. REDACLE_HV centers:

<table>
<thead>
<tr>
<th>id</th>
<th>name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>INFN-FNAL</td>
</tr>
<tr>
<td>2</td>
<td>CERN/Lab27</td>
</tr>
<tr>
<td>3</td>
<td>CERN/Hi4</td>
</tr>
<tr>
<td>4</td>
<td>CERN/Hi2</td>
</tr>
<tr>
<td>5</td>
<td>CERN/Hi2</td>
</tr>
<tr>
<td>6</td>
<td>INFN/Coms1</td>
</tr>
<tr>
<td>7</td>
<td>CERN/Hi6</td>
</tr>
</tbody>
</table>

- **Change Crate Composition Interface**: use this interface each time a board/module is removed from a crate and/or inserted in another crate.

- **Return to CAEN Interface**: use this interface each time a part is sent to Caen or received from Caen. Shipping dates and log messages are stored in the DB.

- **Board Calibration Interface**: to insert calibrations from files or to update a calibration table.
The HV cabling inside a SM
This is described in a separate guide: MontaggioCaviHV.pdf

Multimeter test

This test has to performed once all the MB are connected and must be repeated when the cooling block is installed and at any time one wants to check the HV connections.

Turn on the multimeter in mode Ohm-meter and turn on the BEEP. Connect the red sensor to one HV+ pin and the other to the corresponding HV Sense. These two pins should be short-circuited if all is well connected and the multimeter should indicate a small resistance (order of a few Ohm) and BEEP.

Proceed with this check for all the HV channels and their sense on one side and on the other side of the connector.

Then check the ground connection by connecting the multimeter sensor to one ground pin and moving the other sensor over all the other grounds and ground sense. They should be all short-circuited.

If something does not BEEP inform the MotherBoard team.