

## BEMC/BSMD

O.Tsai, 04/13/2006  
Latest Update 01/30/2014

### Detector Operator Manual, Run 14

You will be operating three detectors:

(**BTOW**) Barrel Electromagnetic Calorimeter

(**BSMD**) Barrel Shower Maximum Detector

These two detectors are delicate instruments and require careful and precise operation.

It is **critical to consult** and follow the “**STAR DETECTOR STATES FOR RUN 14**” and “**Detector Readiness Checklist**” for instructions.

**If you have a concern of what you are going to do with any of these detectors please don't hesitate to ask people around you in the control room or call experts to get help or explanations.**

This manual will tell you:

1. how to turn On/Off low and high voltages for all three detectors.
2. how to prepare BTOW for “Physics”.
3. how to recover from a PMT HV Trip.
4. how to deal with common problems.

#### Contents:

Prepare for Physics	3-5
CANBUS/HDLC	6-8
PMT Low Voltage	8, 20
PMT High Voltage	9-15
SMD High Voltage	1
Troubleshooting	19

First, familiarize yourself with the environment of the control room. This is a picture of the four terminal windows which you will be using to operate the BEMC systems. For run 13 Terminal 4 is not in use. The terminal 0 not shown it is on the left side from terminal 1.



- 0 - (on [beatrice.starp.bnl.gov](http://beatrice.starp.bnl.gov)) - BEMC Main Control Window
- 1 - (on [emc02.starp.bnl.gov](http://emc02.starp.bnl.gov)) - BEMC PMT Low Voltage Power Supply Slow Control
- 2 - (on [emcsc.starp.bnl.gov](http://emcsc.starp.bnl.gov)) - BTOW HV Control
- 3 - (on [hoosier.starp.bnl.gov](http://hoosier.starp.bnl.gov)) - BSMD HV Control

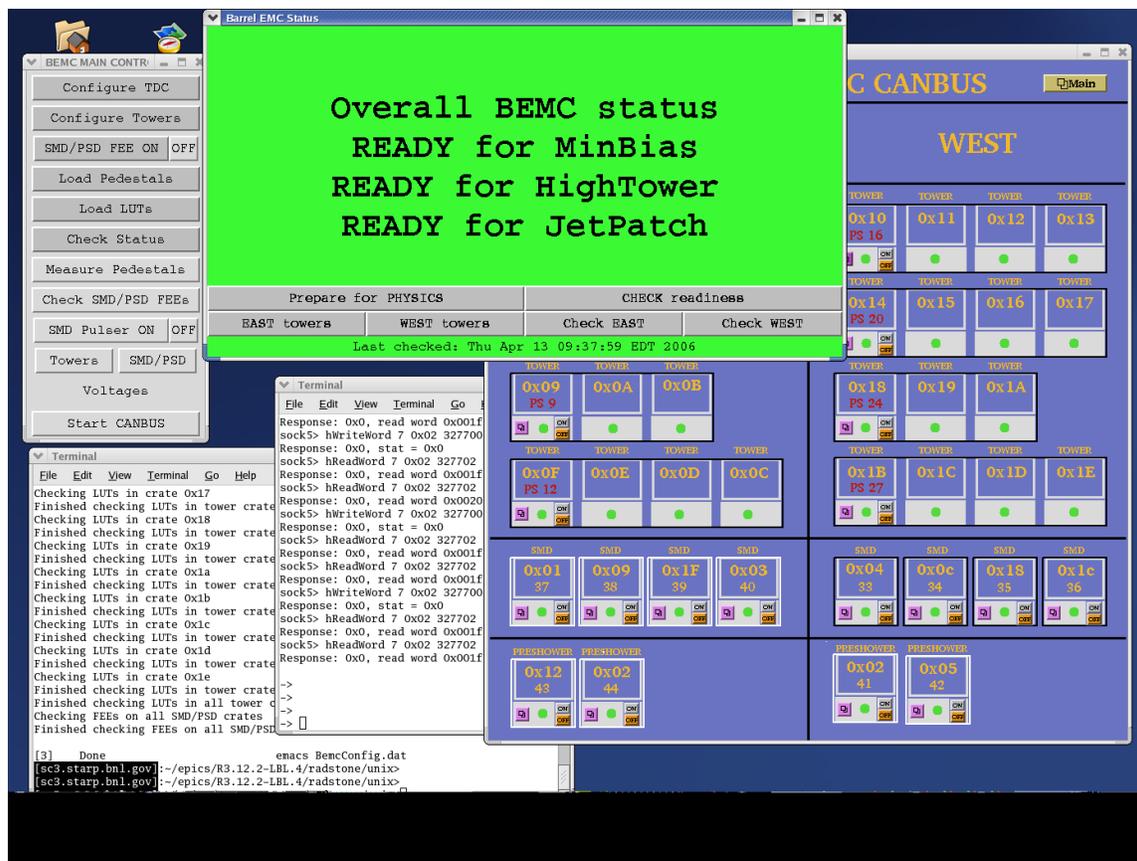
To login on any of these computers use the emc account with password

## Terminal 0 “BEMC Main Control Window”

Usually this terminal is logged on to [beatrice.starp.bnl.gov](http://beatrice.starp.bnl.gov)

The list of tasks which you will be doing from this terminal is:

1. Prepare BEMC detectors for Physics.
2. Turning On/Off low voltages on FEEs.
3. Turning On/Off BEMC crates.
4. Resetting Radstone Boards (HDLC).
5. Explain to experts during phone calls what you see on some of the terminals.



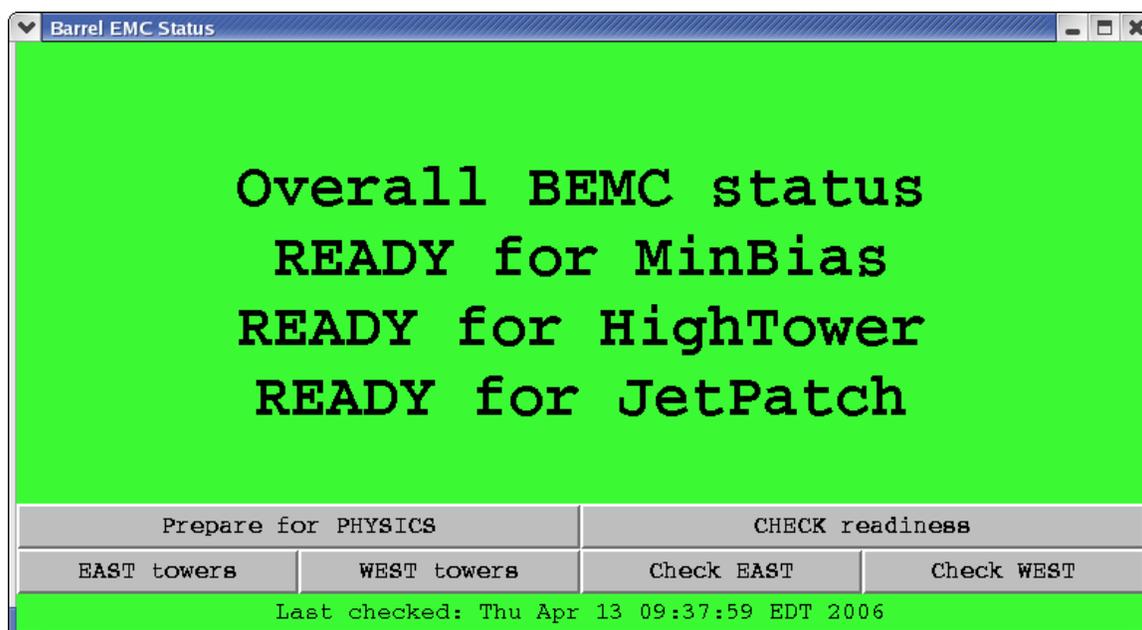
The screenshot above shows how the display on [emc02.starp.bnl.gov](http://emc02.starp.bnl.gov) usually looks during the run. There are five windows open all the time. They are:

1. “Barrel EMC Status” - green.
2. “BEMC MAIN CONTROL” – gray.
3. “BARREL EMC CANBUS” – blue.
4. Terminal on [sc5.starp.bnl.gov](http://sc5.starp.bnl.gov) (referred to as the ‘sc5 window’)
5. Terminal from [telnet scserv 9039](http://telnet.scserv.9039) (referred to as ‘HDLC window’)

## Prepare BEMC detectors for PHYSICS.

Front End Electronics for BEMC usually got reconfigured automatically every time shift crew starts the run with BTOW included in the run. However, if DAQ critical message will tell shift crew to do “Prepare for physics” detector operators will need to do it by hand.

BSMD front end electronics can be configured only by hand, i.e. in case of massive power dip, FEEs for BSMD need to be turned ON by hand from BEMC MAIN CONTROL window.



Click “Prepare for PHYSICS” button and in about *10 minutes* “Barrel EMC Status” window will turn green and tell you that you are ready to run. This window may look a little bit different from year to year depending trigger requirements for BTOW.

However if this window turns **red**, then you will be requested to follow the suggested procedures which will pop-up on this window: simply click on these procedures to perform them.

During “prepare for physics” you can monitor the messages on the sc5 window. This will tell you what the program is actually doing. For example, when you click “Prepare for Physics” you will start a multi-step process which includes:

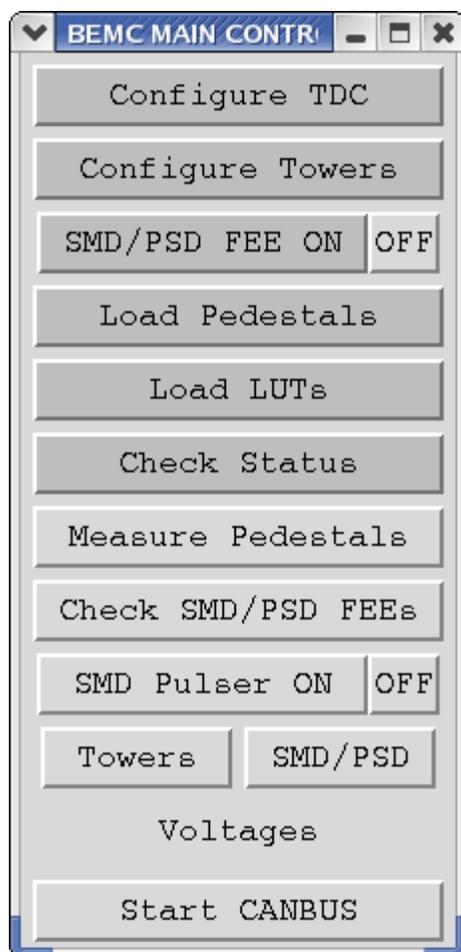
1. Turning OFF FEEs on all SMD/PSD crates
2. Programming TDC (Tower Data Collector, Crate 80)
3. Reprogramming FPGAs on all BTOW crates
4. Configuring all BTOW crates
5. Configuring all SMD FEEs

6. Loading pedestals on all BTOW crates
7. Loading LUTs on all BTOW crates (only for pp running)
8. Checking BTOW crate configuration
9. Checking SMD configuration
10. Checking that pedestals were loaded correctly (optional)
11. Checking that LUTs were loaded correctly (only for pp running)

Usually, you will not be asked to use any other buttons shown on this window.

## BEMC MAIN CONTROL

You can initiate all steps outlined above manually from the BEMC MAIN CONTROL window shown below, and do much more with the BEMC system. However, during normal operation you will not be asked to do that, except in cases when an expert on the phone might ask you to open some additional window from this panel and read back some parameters to diagnose a problem.



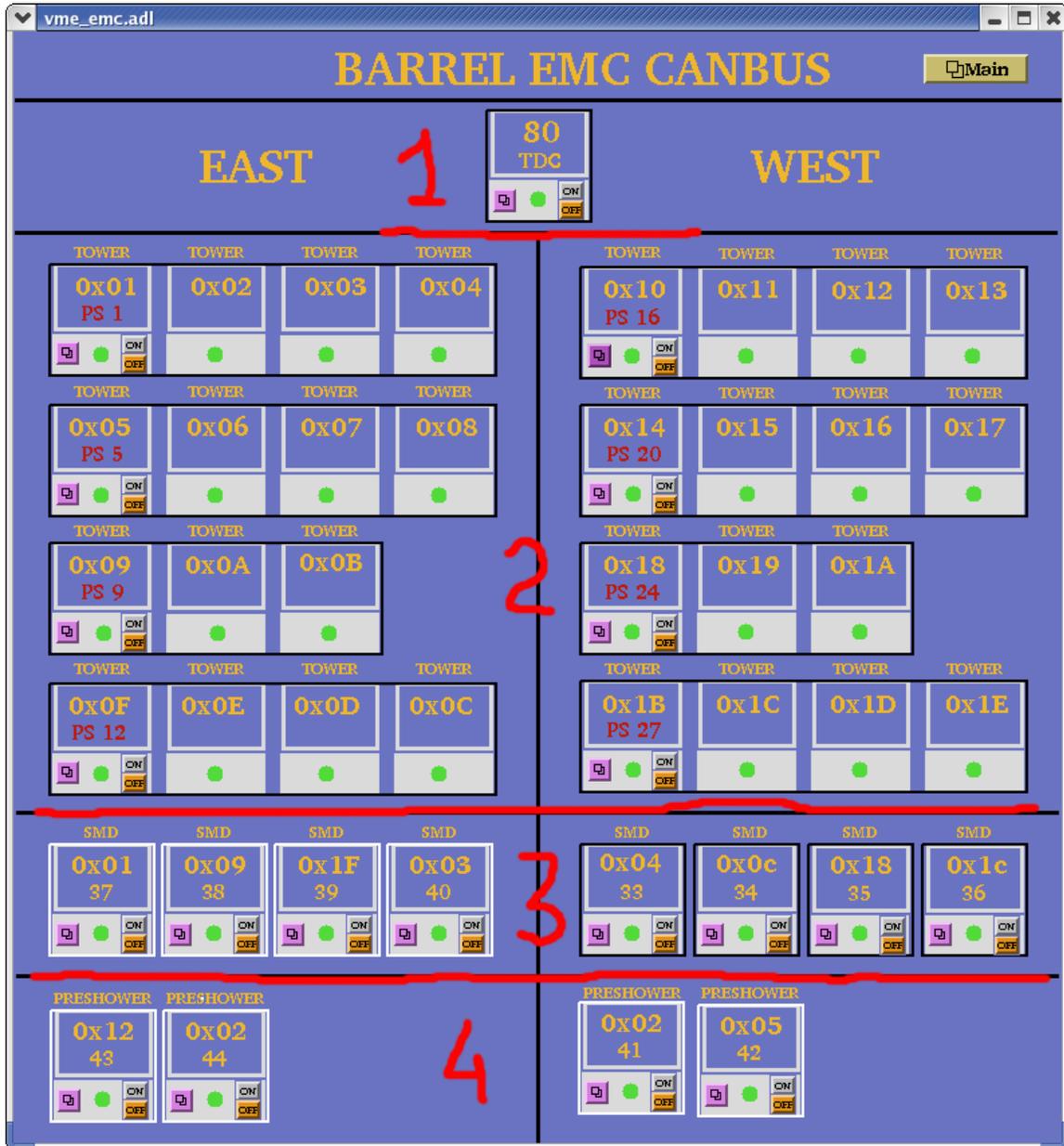
You might be asked:

1. to turn OFF or ON **SMD FEE**
2. Open **SMD** panel and read voltages and currents on different SMD/PSD FEEs
3. Open East or West panels to read voltages on some BTOW crates. (Click on **Voltages**)

That will help experts to diagnose problems you are calling about.

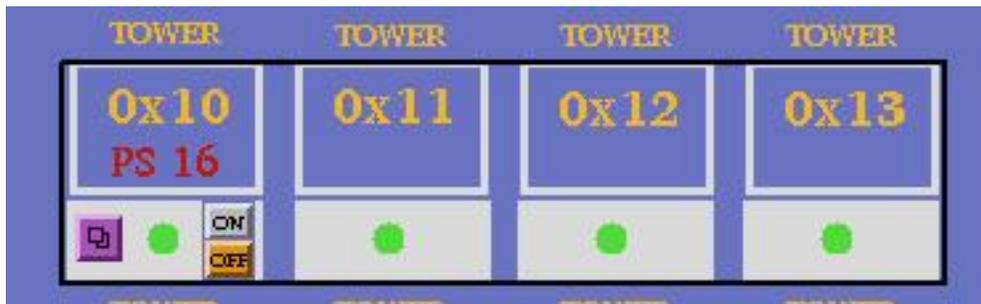
## BARREL EMC CANBUS

From this window you can turn Off and On BEMC crates, read parameters of VME crates. This screenshot shows you this window during normal operation with all BEMC crates being ON.



- 1- Crate 80 TDC (Tower Data Collector and “Radstone boards”)
- 2- Thirty crates for BTOW
- 3- Eight crates for BSMD
- 4- Four crates for BPSD (discontinued)

The BTOW crates are powered in groups of three or four from a single power supply (PS) units. The fragment below explains what you see.



Tower crates 0x10, 0x11, 0x12, 0x13 are all powered from a single power supply: **PS 16**. Thus, by clicking the On and Off buttons you will be switching On/Off all four crates and the communication with PMT boxes which are associated with them. (see details in Tower HV Control GUI description).

### Sc5 and HDLC windows.

Two other terminal windows on “Terminal 0” are the so-called **sc5**, and **HDLC** windows. These need to be open at all times. To open the sc5 terminal you will need to login as *sysuser* on *sc5.starp.bnl.gov* with password \_\_\_\_\_

From this sc5 terminal you run two programs. The first program is *emc.tcl*. If you need for some reason to restart “BEMC MAIN CONTROL” or “Barrel EMC Status” GUI you need to start *emc.tcl*: the alias for this is **emc**. To kill this program use alias **kill\_emc**.

To open “Barrel EMC Canbus” GUI use alias **emc\_canbus\_noscale**.

If you need to reboot canbus then:

1. open sc5 window
2. *telnet scserv 9040*
3. press “Ctrl” and “x” keys
4. wait while canbus reboots (~5 minutes or so)
5. press “Ctrl” and “]” keys
6. *quit* telnet session
7. close sc5 window

To open an **HDLC** window, first you need to open an sc5 window and then *telnet scserv 9039*.

To close telnet session you need to press “Ctrl” and “]”, and then *quit* from telnet.

You may be asked by experts on the phone to reset the radstone boards. This is why you need this window open. There are two radstone boards and to reset them type:

-> *radstoneReset 0*      and      -> *radstoneReset 1*

## Terminal 1. “BEMC PMT Low Voltage Power Supply Slow Control”

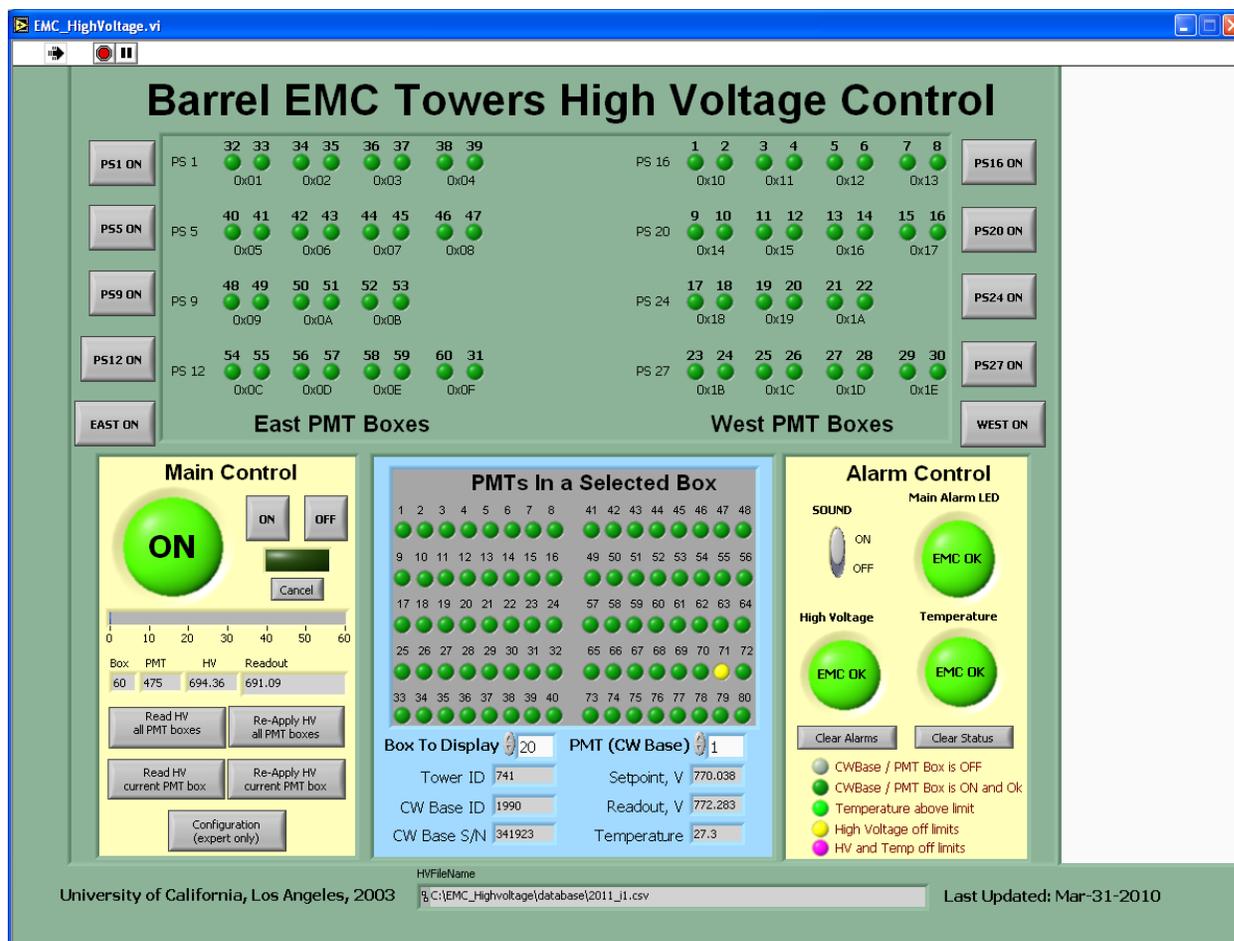
There are two low voltage power supply PL512 units which powers PMT bases. PL512 with IP address 130.199.60.79 powers West side and PL512 with IP address 130.199.60.81 powers East side of the detector. A single power supply feeds thirty PMT boxes. The GUI for both PL512 should be open all time on one of the workspace on Terminal1. A screenshot below shows GUI at normal conditions for one of the PL512 (West side). Both PL512 should be ON all the time, except the case when power cycling of the PMT bases is required. There are two buttons to turn power On and Off, as usual, wait 30 sec. after turning power supply Off before you will turn it On again. To start GUI use aliases `bemc_west` and `bemc_east` on `sc5.starp.bnl.gov`.

The screenshot shows a web-based GUI titled "PowerSupply.adl (on sc5.starp.bnl.gov)". The main heading is "BEMC PMT LV West". There is a green indicator light and two buttons labeled "Off" and "On". Below the heading, there is a table with the following columns: "Uninhibit SwitelOn", "Status", "Sense V", "Term. V", "Current", and "Temp.". The table lists 12 PMT units (U0 to U11) with their respective status and sensor readings.

	Uninhibit SwitelOn	Status	Sense V	Term. V	Current	Temp.
U0	● Enabled	On	5.47	7.1	10.1	23
U1	● Enabled	On	5.46	7.2	8.9	29
U2	● Enabled	On	5.45	6.9	8.6	28
U3	● Enabled	On	5.46	6.9	10.0	24
U4	● Enabled	On	5.20	5.4	0.7	24
U5	● Enabled	On	5.20	5.4	0.7	22
U6	● Enabled	On	5.21	5.4	0.7	24
U7	● Enabled	On	5.21	5.4	0.8	22
U8	● Enabled	On	12.21	13.0	2.4	23
U9	● Enabled	On	12.19	13.1	2.5	26
U10	● Enabled	On	12.22	12.9	2.3	24
U11	● Enabled	On	12.20	12.8	2.8	27

## Terminal 2. “BTOW HV Control”

*Use this controls only when shift crew notify you of a problems with BEMC HV.*



This is typical screen shot of the BTOW HV GUI during “Physics” running.

What is shown on this screen?

The top portion of the screen shows the status of the sixty BTOW PMT boxes.

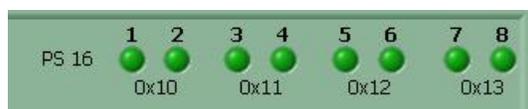
In this color scheme green means OK, yellow means bad, gray means masked out.

**Buttons marked “PS1 ON” etc. allows to ramp slowly HV on the groups of the boxes.**

(PS1 ON will bring only boxes 32-39)

**Buttons “EAST ON” and “WEST ON” allows to ramp up slowly entire east or west sides.**

The fragment below explains what the numbers on this screen means.



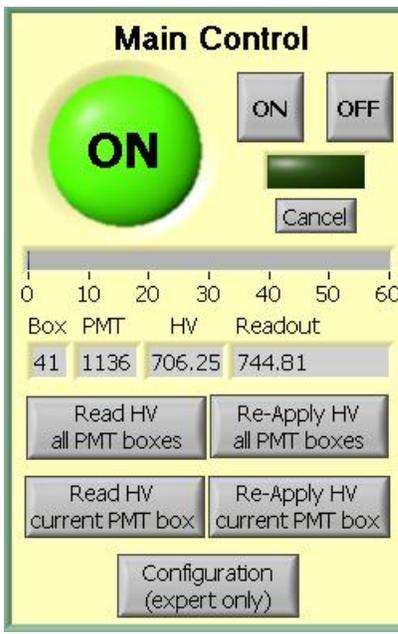
Each green dot represents a single PMT box. Label 0x10 tells you that signals from PMTs in boxes 1 and 2 feed to BTOW crate 0x10, boxes 3 and 4 feed crate 0x11 etc. You will need to know this correspondence to quickly recover from HV trips.

**Turning ON HV on BTOW from scratch.**

*In case of massive power loss in STAR notify experts and try to restore HV only on the West Side of the BEMC. Procedure to handle East Side described at the end of this section.*

1. BEMC PMT LV East and West should be ON.
2. EMC\_HighVoltage.vi should be running.
3. Made a slow ramp on the West Side by pressing button “WEST ON”

**Subpanel “Main Control”**

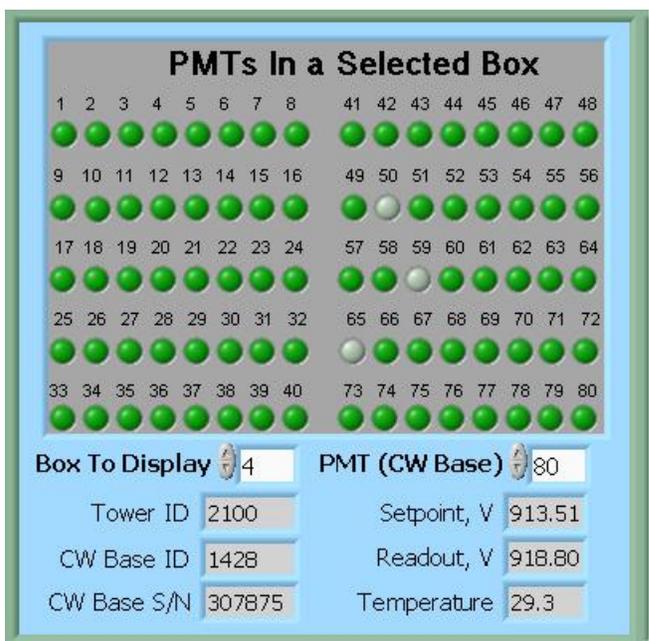


The HV on PMTs is usually ON during the Run. The two buttons on top are for turning the HV On and OFF on all PMT boxes. The most frequently used button on this subpanel is “Re-Apply HV all PMT Boxes” which is usually used to recover after HV trip. Sometimes you will need to “Re-Apply HV current PMT box” if the system does not set the HV on all boxes cleanly.

The scale 0-60 shows you a progress report. The small icons below this scale tells you what PMT box and PMT were addressed or readout.

Once you recover from a HV trip please pay attention to the small boxes labeled “Box”, “PMT”, and the speed at which the program reads the voltages on the PMTs. This will tell you which box has “Timeout” problems and which power supply will need to be power cycled.

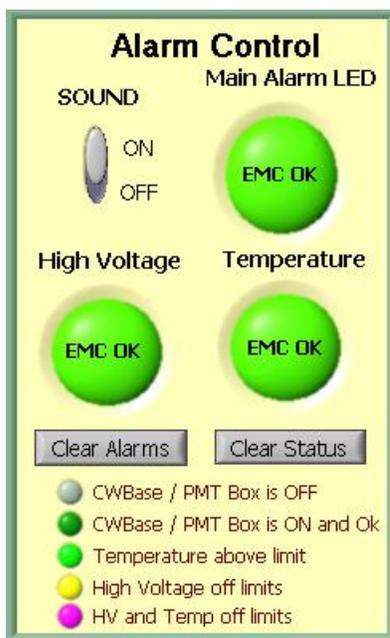
**Subpanel “PMTs In a Selected Box”**



This subpanel shows you the status of the PMTs in a given PMT box.

If you want to manually bring a single PMT box to the operational state by clicking on “**Re-Apply HV current PMT box**” on the Main Control subpanel you will need to specify which **Box To Display** on the panel first.

**Subpanel “Alarm Control”**



On the Alarm Control sub-panel the **SOUND should be always ON**, except for the case when you are recovering from a HV trip and wish to mute this annoying sound.

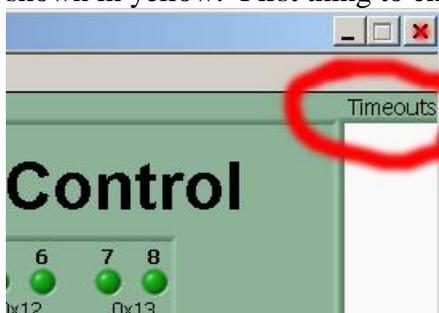
Shift personnel are asked to report HV trips in the shift log (type of trip, e.g. single box#, with or without timeout, massive trip, etc...)

Please don't forget to switch this button back to the ON position after recovering from a trip.

The Main Alarm LED will switch color from green to red in case of an alarm.

### HV trip with **Timeout** problem.

Typical situation – you hear a sound alarm indicating a HV trip. The auto-recovery program did not bring all PMT boxes to the operational state, e.g. some boxes will be shown in yellow. First thing to check for the presence of a “Timeout” problem.



Look at the right upper corner of the GUI. If the field below “Timeouts” is blank then try to recover by re-applying HV to all PMT boxes if the number of bad boxes more then two. If only one or two boxes is yellow then you can try to re-apply HV to the current PMT box.

If only one or two PMT bases timed out and HV tripped try to recover using above procedure. It is possible that one or two PMT bases will timed without causing trips of HV, then just continue running and made a note in the shift log about timed out PMT bases, experts will take care of this problem during the day.

But it is also a chance that a single timed out PMT base will trip lots of other PMT. In this case this bad PMT should be masked out. The procedure to do this is simple and can be found at the end of this manual. However, this is an expert operation and should only be performed after consulting with a BEMC expert.

If the field below “Timeouts” is filled with multiple numbers (these are PMTs addresses) then you have a **Timeout** problem. The procedure to recover is below:

- 1) notify shift leader about this problem and tell him that it will take at least 20 min. to bring back BEMC for Physics running.

- 2) Second, try to identify which PMT box has timeouts (usually it will be first box in yellow counting from 1 to 60). If you are not sure which box has the timeout problem then read all pmt boxes by clicking on corresponding button at the “Main Control” subpanel, and observe which box creates the problem. The box with timeout problem will be responding VERY slowly and will be clearly seen on the “Main Control” subpanel. At the same time, PMTs addresses will be appear in “Timeouts” white space to the right of the green control panel.
- 3) As soon as you find the box with the timeout problem, click “Cancel” on the “Main Control” subpanel and then click “OFF” – you will need to turn HV OFF on all PMTs.
- 4) Wait till HV is shut OFF (all PMT Boxes).
- 5) From Terminal 1, power cycle correspondent BEMC PMT LV East or West (Off, wait 30 sec., On).
- 6) Now turn ON HV on PMT boxes from the “Main Control” subpanel. It will take about 2 to 3 minutes first to send desired voltages to all PMTs and then read them back – if the HV is set correctly.

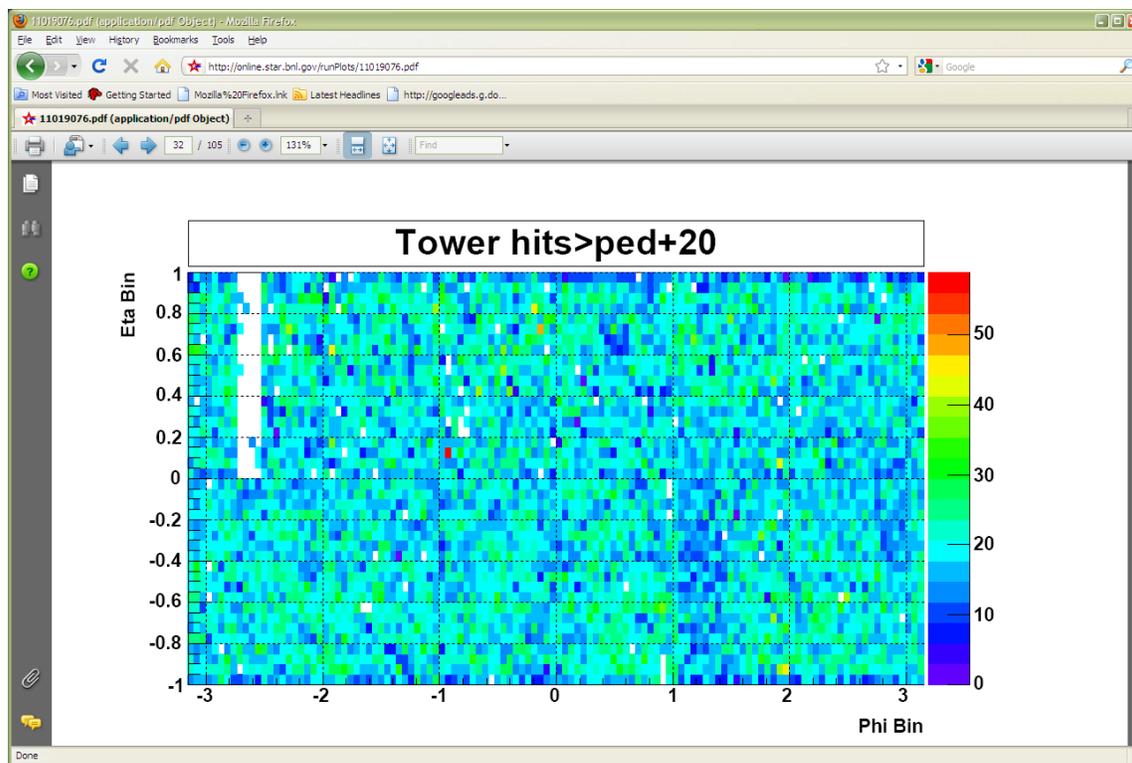
It is possible that during step (6) one of the BEMC PMT LV on the East or West side will trip. In this case cancel ramp (press “Cancel” button on the “Main Control” subpanel). Power cycle tripped BEMC PMT LV. Proceed with the slow ramp

However, if during step (6) you still get a “Timeout” problem then you will need to:

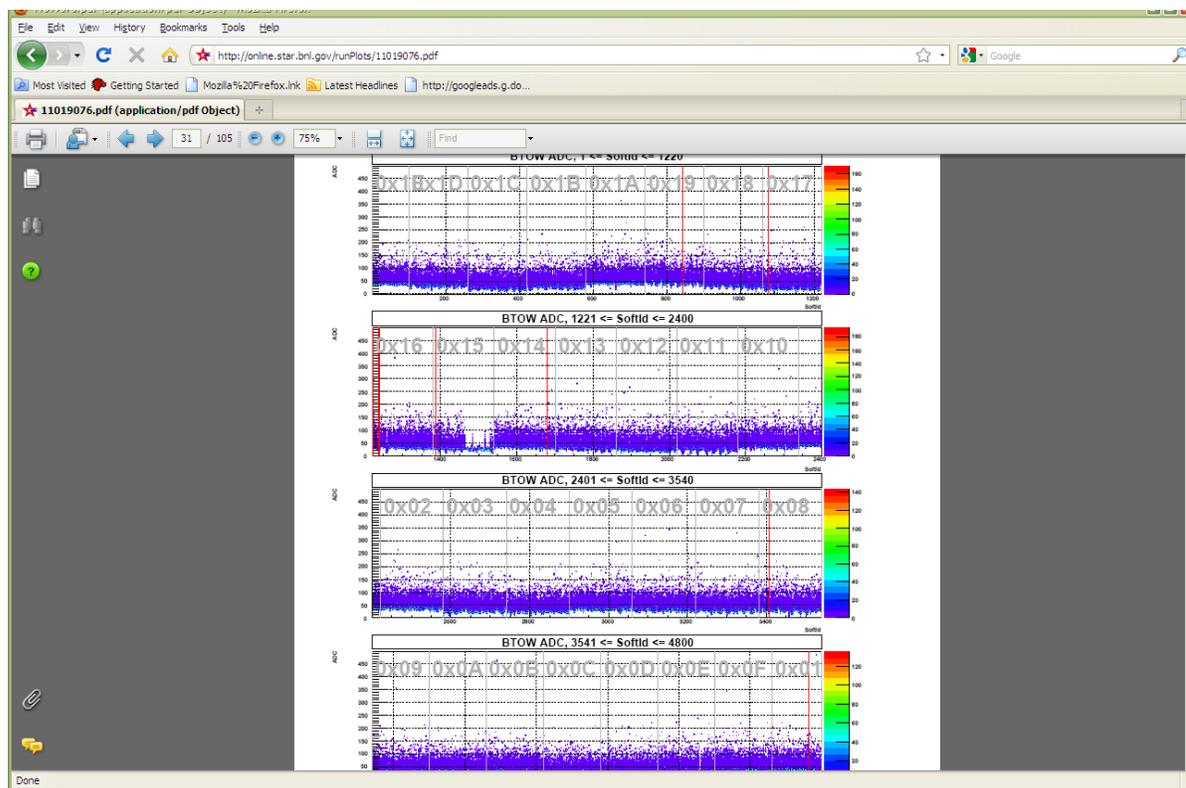
- 1) Call experts

---

To reduce the number of HV trips and associated efficiency losses during data taking we changed functionality of the PMT HV program. Namely, the HV read back time interval was changed from 15 minutes to 9999 hours, because it was found that most of the HV trips were self induced during HV read back. As a result efficiency of data taking was improved for the price of “conscious operation”. You can’t rely anymore on absence of the HV Trip alarm as an indicator that HV on all PMTs is at nominal values. Instead shift crew should monitor associated online plots during data taking to be sure that HV was not tripped. In particular, for Run 13, shift crew should watch two plots “ADC Eta Vs Phi” and “Tower ADC” under the “BEMC Shift” tab. Example of missed HV trip on one of the PMT box during recent data taking is shown below.



The white gap in the upper left corner shows absence of hits in BTOW due to HV trip in one of the BTOW PMT Box. It is easy to find out which box tripped by looking at second plot.



The gap with missing hits on the second subpanel for crate 0x15 will tell you that one of the PMT box 11 or 12 was tripped (correspondence between BTOW crates ID and PMT boxes is shown in the BTOW HV GUI see the picture at the beginning of this section).

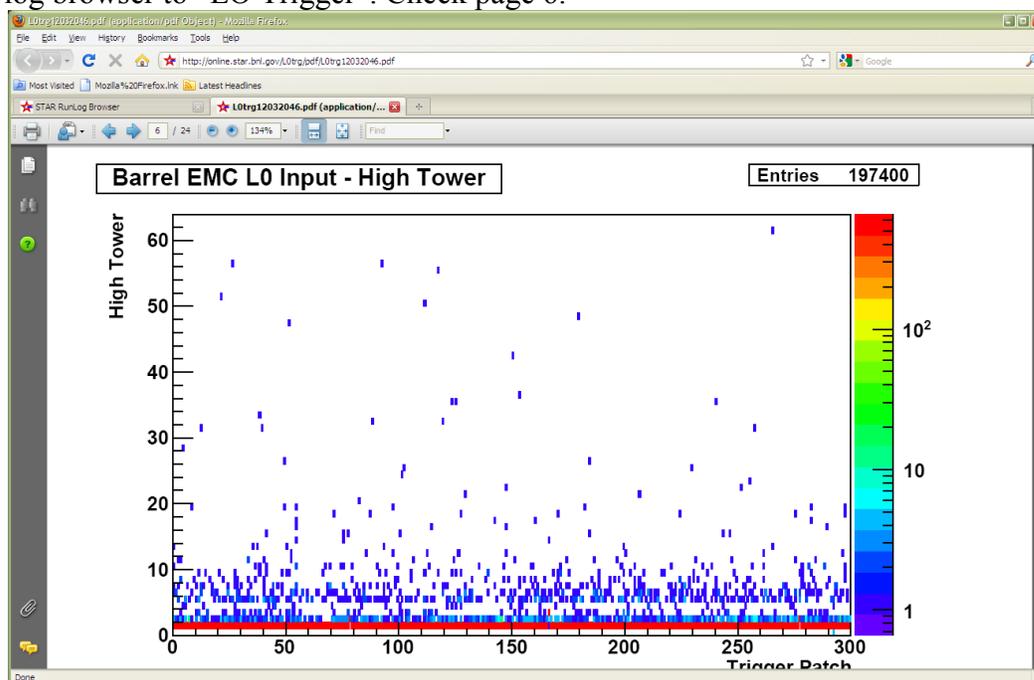
What to do if shift crew will notify you of HV trip?

The fastest way to recover is to identify what box tripped and then try to recover only this PMT box. In some case it will be impossible to do this, because you will be needed to powercycle LV power supply for PMT HV system (timeout problems).

This is typical scenario:

1. Identify which PMT box(es) potentially tripped. (In the example above one PMT box 11 or 12 lost HV) to do that:
  - 1.1 From the BTOW HV GUI form subpanel “**PMTs In a Selected Box**” select needed box in the “**Box To Display**” window.
  - 1.2 From the BTOW HV GUI form subpanel “**Main Control**” press “**Read HV current PMT Box**”. (In the example above, detector operator found that Box 11 was OK after reading HV, but Box 12 had timeout problems).
  - 1.3 Depending what will be result of (1.2) you may need to simply Re-Apply HV to current PMT box (no timeouts during step (1.2), or you will need to resolve timeout problem.

There are additional duties for detector operators when STAR is not taking data for long period of time for any reasons. We need to keep HV On on all PMTs at all time. This will assure stable gains on PMTs. If for some reasons PMTs will be Off for long time (few hours) then it will be difficult to assure that the PMTs gain will not drift once we turn HV On again. Typical situation is APEX days, when STAR is not taking data for 12 hours or so. To check that HV is on shift will be asked to take a short run 1k events using “bemcHTtest” configuration. TRG+DAQ+BTOW only. Once the data will be taken use a link from the run log browser to “LO Trigger”. Check page 6.



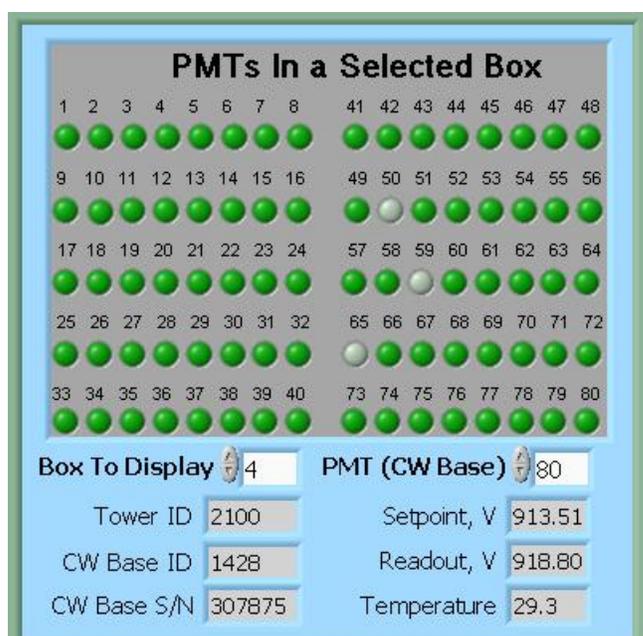
All trigger patches should have some hits. In case of the HV trips you will see blank spots.

### Procedure to mask out single timeout PMT base.

Information you will need:

1. In which PMT box timeout PMT base is located
2. PMT (CW Base) to masked out.

In the timeout window the displayed number is **CW Base ID** this number need to be translated to **PMT (CW Base)**.



From this sub panel you can find out which PMT in the affected PMT box need to be masked out. Scroll thru the **PMT (CW Base)** top right small window and read out at the same time **CW Base ID** in the second from the bottom left window. (As shown, PMT (CW Base) 80 correspond to CW Base ID 1428).

Now, click “Configuration (expert only)” button on the Main Control panel.

Another panel [EMC\\_Configuration.vi](#) will open.

From this panel click “CW Bases Configuration” button on the right bottom.

Another panel [EMC\\_CWBasesConf.vi](#) will open.

On this panel specify PMT BOX Number and then click on desired CW Base to be masked out. The color of the dot will change from bright green to pale green. Then click OK button. Panel will close after that.

Click OK button on [EMC\\_Configuration.vi](#) panel, this panle will close after that.

To check that you masked out right CW Base, Re-Apply HV to current PMT box. Once HV will be re-applied you will see masked CW base will be in the gray color as shown in the picture above (Bases 50, 59, 65 were masked out in the PMT box 4).

### Terminal 3. “BSMD HV Control”

The screenshot shows a Windows desktop environment. On the left, there is a taskbar with various application icons. The main window is a LabVIEW GUI titled 'GH VOLTAGE CONTROL'. The GUI has a blue header with the title in red. Below the header, there are several control elements: a 'Current Mode' display, an 'ALARM' section with a 'MUTE ALARM' button and an 'Alarm Status' indicator, and a 'Current Time' display showing '4:37:28 PM'. Below these, there is a 'Time Remaining for HV Ramp Up' display showing '0 sec'. The main area of the GUI is divided into two sections: 'SMD Module Status' and 'Interlock'. The 'SMD Module Status' section has a legend with five categories: HV ON (green), HV ON/NI CURRENT (orange), HV ON/NO VOLTAGE (yellow), HV OFF (red), and HV DISABLED (black). Below the legend are two columns of status indicators for 'WEST RING' and 'EAST RING', each with 12 rows of indicators. The 'Interlock' section has two green circular indicators. In the background, a terminal window titled '130.199.60.50 - PuTTY' is open, displaying a table of channel data. The table has columns for Channel ID, Channel Name, V0Set, I0Set, VMon, IMon, Pw, Status, and Ch#.

Channel ID	Channel Name	V0Set	I0Set	VMon	IMon	Pw	Status	Ch#
CHANNEL00							0.00	0.00
CHANNEL01							0.00	0.01
CHANNEL02							0.00	0.02
CHANNEL03							0.00	0.03
CHANNEL04							0.00	0.04
CHANNEL05							0.00	0.05
CHANNEL06							0.00	0.06
CHANNEL07							0.00	0.07
CHANNEL08							0.00	0.08
CHANNEL09							0.00	0.09
CHANNEL10							0.00	0.10
CHANNEL11							0.00	0.11
CHANNEL12							0.00	0.12

Your login name is **emc**, your password is \_\_\_\_\_

This screenshot shows how the window on the terminal3 will look when the HV is Off on the BSMD modules. There should be two open windows. One is a LabView GUI and another is a telnet session SY1527 (CAEN HV Main Frame).

In normal operation it is a one click procedure to turn the HV On or OFF on the BSMD.

There is complete description of the BSMD HV program in a separate folder in this document.

Although, operation is very simple, attention should be made for audio alarms.

**Do not mute the ALARM.** Shift personnel are asked to report all BSMD trips in the shift log.

## Easy Troubles:

BEMC Main Control seems to be frozen, e.g. program doesn't respond to operators requests.

Probable reason: RadStone cards in a "funny state" and needs to be reset

From Terminal 1 try to:

- a) **kill\_emc**
- b) soft reboot first "Ctrl" + "x" from HDLC terminal window.
- c) start **emc** and see if problem solved

if the problem is still there then:

- a) **kill\_emc**
- b) Power Cycle Crate 80 (Wait 3-5 min. for crate to reboot)
- c) start **emc** and see if problem solved

if problem is still there call for experts

### ***BSMD – Problems to start the run.***

Run didn't start after shift crew tried to reboot BSMD from the Run Control.

Typical error message he will see will be something like this:

08:09:591 bsm02 CRITICAL bsmMainesbTask.C:#1872 Recovery failed for RDO(s): 5 -- stopping run!

Detector Operator need to do three simple steps:

1. Turn OFF all BSMD FEEs
2. Power cycle BSMD Crate
3. Turn On all BSMD FEEs

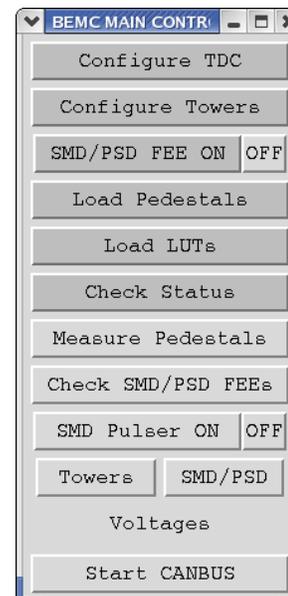
### **PL512 Information (Run10 configuration, for experts only)**

There are two PL512 power supplies which provides power to the BEMC PMT boxes.

Both are located in the rack 2C2, second floor.

The top unit (IP address 130.199.60.79) serves West side of the detector.

The bottom unit (IP address 130.199.60.81) serves East side of the detector.



The connection scheme is shown below

#### PMT Boxes

West side				East Side			
1-8	9-16	17-22	23-30	32-39	40-47	48-53	54- 31
U0,4,8	1,5,9	3,7,11	2,6,10	0,4,8	1,5,9	3,7,11	2,6,10
U 0,1,2,3 +5 V							
U 4,5,6,7 -5 V							
U 8,9,10,11 +12 V							

Note , BEMC PMT Low Voltage Power Supply Slow Control channels enumerated from 1 to 12 in LabView version of GUI.

#### **Alternative way to run slow control for PMT LV power supplies (Experts only).**

Slow control for PL512 runs on EMC02, login as emc, alias PMT\_LV.  
 You will need to specify IP address. 130.199.60.79 –East, 130.199.60.81 –West.  
 Configuration (Experts Only) password is \_\_\_\_\_.  
 Log files will be created each time you will start PMT\_LV in the directory  
 /home/emc/logs/  
 for example  
 /home/emc/logs/0703121259.txt (March 12, 2007, 12:59)

#### **To restart PL512 epics applications.**

Login to softioc1.starp.bnl.gov bmc/star\_daq\_sc  
 Look at procIDs  
 ->screen –list  
 ->screen –r xxxx.Bemc-west(east) xxxx is procID  
 ->bemclvps2 > (ctrl A) to detach  
                   exit to kill  
 ->BEMC-West or East to restart

#### **Experts control for PL512**

If you need to adjust LV on PL512 you can do this using expert\_bemc\_west or (east).  
 These GUI has experts panel. Adjusting LV setting DO NOT try to slide the bars.  
 Instead click on it then on popup window you can simply type desired value.  
 Make sure you will close expert GUI and return to normal operational GUI once  
 you will finish adjustments.

#### **PowerCycle SY1527**

<http://bemcpower.starp.bnl.gov> apc/emcwsu

