

CLAS12 Slow Controls Operations Manual - v2.6

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I. Overview

The operator interface for the Hall B controls systems is based on Control System Studio (also called CS-Studio or CSS) and allows access to all the necessary EPICS tools from a single application. This system is accessible by user `clasrun` directly from all `clonpc##` desktop computers in the Hall B Counting Room for shift workers (for remote access, see Section IX).

To start the control system with only the main menu as shown in Figure 1, in a terminal run:

```
clascss
```

This menu should normally already be open on all the necessary desktops in the counting house. The top portion of the menu is for specific detectors, while the bottom portion is for more general subsystems, and the most important parts for shift workers are described in the following sections.

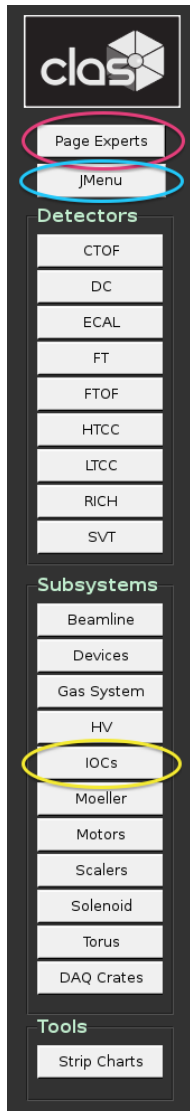


FIG. 1: The main menu.

II. Alarms

The user interface for the alarm handling system also runs in CS-Studio and includes visual and audible alarms. Generally, `clonpc17` (with the two high monitors near the windowed doors) should always be running a full screen alarm handler. To start the control system with the full alarm handler, in a terminal run:

```
clascss-alarm
```

The resulting window is shown in Figure 2 and contains the following sections:

1. Top Left: the *Area Panel*, an overview of the global alarm system status. The color of the areas reflects the most severe alarm in that area.
2. Bottom Left: the *Alarm Tree*, a hierarchical view of all alarm settings.
3. Bottom Right: the *Alarm Table* (see also Figure 3), containing a list of current alarms that need to be addressed and a separate list of already acknowledged alarms.

When an alarm triggers, it will enter the *Alarm Table* and its color will change according to its severity. The annunciator (running on `clonpc17`) will also audibly announce any new alarms or a count of currently active alarms.

The screenshot displays the 'BPMs Alarm Settings' interface. On the left, there is an 'Alarm Area Panel' with buttons for various systems: Beamline, Solenoid, Torus, CTOP, FTOP, DC, ECAL, PCAL, HTCC, LTCC, SVT, Weather, DAQ, and COMMS. Below this is an 'Alarm Tree' showing a hierarchical view of the alarm system, including areas like Beamline, Solenoid, and Torus, and systems like Beam Position, Beam Current, and Beam Vacuum. The main window is titled 'BPMs Alarm Settings' and contains a table of alarm settings. The table has columns for Channel, Value, LOLO, LO, HI, HIHI, and alarm levels (MAJOR, MINOR). The bottom right section shows the 'Alarm Table' with columns for PV, Description, Alarm Time, Current Severity, Current Status, Alarm Severity, Alarm Status, and Alarm Value. The table lists three current alarms, all with a severity of MAJOR and a status of HIHI_ALARM.

Channel	Value	LOLO	LO	HI	HIHI	LOLO	LO	HI	HIHI
2C21A Current	0.000	5.000	6.000	14.000	15.000	MAJOR	MINOR	MINOR	MAJOR
2C21A X-Position	0.000	0.000	0.000	0.000	0.000	MAJOR	MINOR	MINOR	MAJOR
2C21A Y-Position	0.000	0.000	0.000	0.000	0.000	MAJOR	MINOR	MINOR	MAJOR
2C24A Current	0.000	0.000	0.000	0.000	0.000	MAJOR	MINOR	MINOR	MAJOR
2C24A X-Position	0.000	0.000	0.000	0.000	0.000	MAJOR	MINOR	MINOR	MAJOR
2C24A Y-Position	0.000	0.000	0.000	0.000	0.000	MAJOR	MINOR	MINOR	MAJOR
2H01 Current	0.000	1.000	0.000	0.000	0.000	MAJOR	MINOR	MINOR	MAJOR
2H01 X Position	0.000	0.000	0.000	0.000	0.000	MAJOR	MINOR	MINOR	MAJOR
2H01 Y Position	0.000	0.000	0.000	0.000	0.000	MAJOR	MINOR	MINOR	MAJOR
2H05 Current	0.000	0.000	0.000	0.000	0.000	NO_ALARM	NO_ALARM	NO_ALARM	NO_ALARM
2H05 X Position	0.000	0.000	0.000	0.000	0.000	MAJOR	MINOR	MINOR	MAJOR
2H05 Y Position	0.000	0.000	0.000	0.000	0.000	MAJOR	MINOR	MINOR	MAJOR
Feraday Cup Current	0.002	0.000	0.000	0.000	0.000	NO_ALARM	NO_ALARM	NO_ALARM	NO_ALARM

PV	Description	Alarm Time	Current Severity	Current Status	Alarm Severity	Alarm Status	Alarm Value
B_DET_DC_LV_SEC2_R3a	MAJOR alarm: DC LV Voltage S2 R3		OK	NO_ALARM	MAJOR	HIHI_ALARM	1.0
B_DET_DC_LV_SEC2_R2a	MAJOR alarm: DC LV Voltage S2 R2		OK	NO_ALARM	MAJOR	HIHI_ALARM	1.0
B_DET_DC_LV_SEC2_R1a	MAJOR alarm: DC LV Voltage S2 R1	2017/01/29 05:43:29.000	OK	NO_ALARM	MAJOR	HIHI_ALARM	1.0

FIG. 2: The alarm handling screen.

By right-clicking on an alarm in the *Alarm Table*, a dropdown menu of actions is accessible (see Figure 4). This dropdown list contains access to a *Guidance* screen with instructions that should be read and followed on how to deal with the specific alarm.

The next step is to acknowledge the alarm using the *Acknowledge* option in the dropdown menu, which will silence the alarm and move it to the *Acknowledged Alarms* section until it is no longer in an alarm state.

For many alarms there is also an option in the dropdown menu starting with *Open* that will open a screen necessary to address the specific alarm using the information from the *Guidance* screen.

PV	Description	Alarm Time	Current Sev	Current Sta	Alarm Seve	Alarm Statt	Alarm Value
B_SYS_HV_PCAL_SEC2	MAJOR alarm: High Voltage alarm for B_SYS_HV_	2016/11/10 14:32:22.376	OK	NO_ALARM	MAJOR	HIGH_ALARM	HIGH
B_SYS_HV_ECAL_SEC2	MAJOR alarm: High Voltage alarm for B_SYS_HV_	2016/11/10 14:22:00.791	MAJOR	HIGH_ALARM	MAJOR	HIGH_ALARM	HIGH
B_SYS_HV_ECAL_SEC2	MAJOR alarm: High Voltage alarm for B_SYS_HV_	2016/11/10 14:22:00.790	MAJOR	HIGH_ALARM	MAJOR	HIGH_ALARM	HIGH

PV	Description	Alarm Time	Current Sev	Current Sta	Alarm Seve	Alarm Statt	Alarm Value
Acknowledged Alarms (0)							

FIG. 3: The *Alarm Tree* portion of the alarm screen, showing an example of three outstanding alarms to be addressed. The first is no longer in an alarm state (denoted by the *OK* in the *Current Severity* column), and none of the three have been acknowledged (else they would have appeared instead in the lower *Acknowledged Alarms* section).

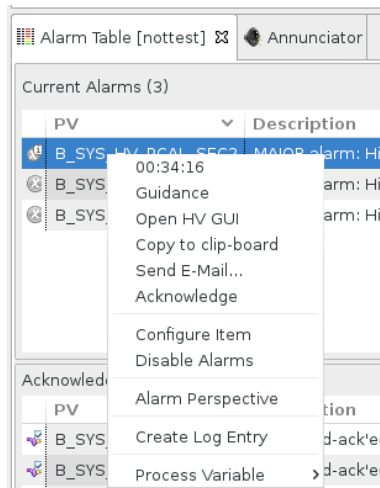


FIG. 4: An example dropdown menu accessible by right-clicking on an alarm in the *Alarm Table*. Important visible actions include a *Guidance* button, an *Open* screen action, and the *Acknowledge* action. **Note, the *Create Log Entry* item does not yet work** (see Section VI instead).

III. IOCs

EPICS input-output controllers (IOCs) are the backend responsible for the actual communication with the hardware devices in the hall. Figure 5 illustrates access to the IOC controls screens from the main CLAS12 menu, as well as the overview IOC heartbeat screen. The heartbeats should be flashing at 1 Hz for all IOCs, or else the IOC may be in need of reboot.

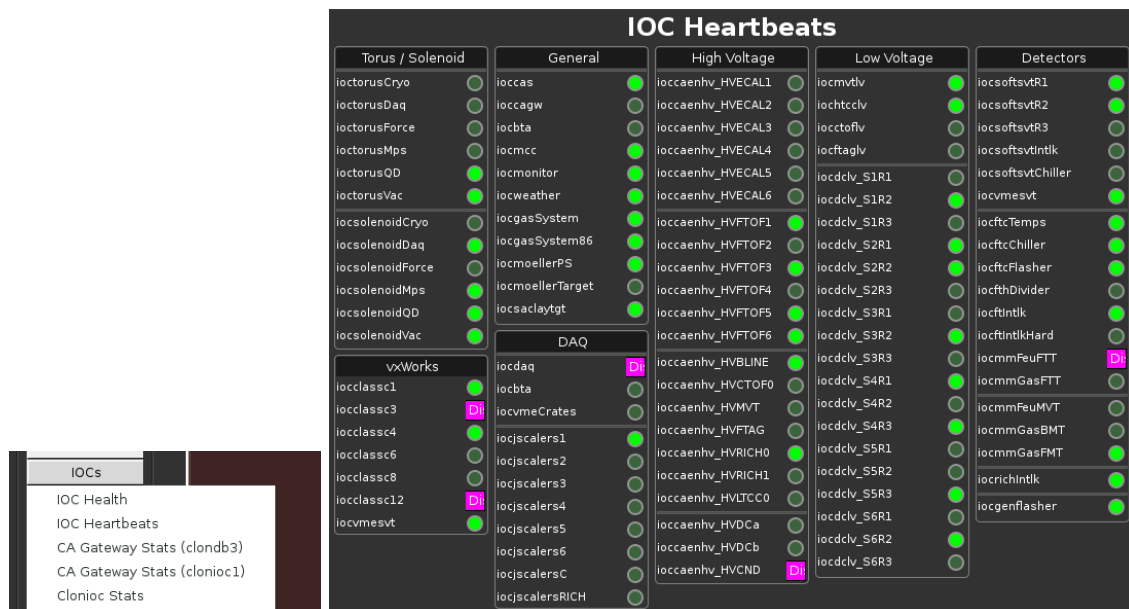


FIG. 5: Dropdown menu (left) from the *IOCs* button in the main CLAS12 controls menu showing links to the IOC health and heartbeat screens (right). The static pink “Disconnected” heartbeats here are IOCs that are intentionally offline at the time of this screenshot.

By clicking on the IOC in the heartbeat screen (or the IOC health screen in the main menu), controls to monitor and reboot the IOCs can be accessed, and an example is shown in Figure 6. Systems are in place to automatically start all necessary IOCs if for any reason they are not running (e.g. recovery from a power outage), however occasionally a manual reboot is required.

A. Motors

The beamline devices in Hall B include encoderless stepping motors. When their IOC is restarted, the actual motor stage position is unchanged (the motor does not move), but the software motor position is reset to zero. If the motor was at a non-zero position during IOC reboot, then a recalibration is required in order for the motor position in EPICS to reflect the actual motor position. This is generally the case for collimators and the beam stopper and viewer motors, because their normal position during running is non-zero. The harps are generally left at zero when not in use and thus do not require recalibration unless in active use during the IOC reboot. See

IOC Name	Hostname	Up Time	Heartbeat	Expert	Soft Reboot	Last Reboot	Console	Hard Reboot
ioccaenhv_HVECAL1	clonioc2.jlab.org	5 days, 03:44:43	445483		Reboot	08/21/2017 11:23:10		Reboot
ioccaenhv_HVECAL2	clonioc2.jlab.org	5 days, 02:31:53	441113		Reboot	08/21/2017 12:36:00		Reboot
ioccaenhv_HVECAL3	clonioc2.jlab.org	5 days, 02:31:53	441113		Reboot	08/21/2017 12:36:00		Reboot
ioccaenhv_HVECAL4	clonioc2.jlab.org	5 days, 02:31:53	441113		Reboot	08/21/2017 12:36:00		Reboot
ioccaenhv_HVECAL5	clonioc2.jlab.org	9 days, 04:50:17	795017		Reboot	08/17/2017 10:17:36		Reboot
ioccaenhv_HVECAL6	clonioc2.jlab.org	5 days, 02:31:53	441113		Reboot	08/21/2017 12:36:00		Reboot
ioccaenhv_HVFTOF1	clonioc2.jlab.org	31 days, 18:19:49	2744389		Reboot	07/25/2017 20:48:03		Reboot
ioccaenhv_HVFTOF2	clonioc2.jlab.org	31 days, 18:19:44	2744384		Reboot	07/25/2017 20:48:08		Reboot
ioccaenhv_HVFTOF3	clonioc2.jlab.org	9 days, 04:51:10	795070		Reboot	08/17/2017 10:16:43		Reboot
ioccaenhv_HVFTOF4	clonioc2.jlab.org	9 days, 04:51:05	795065		Reboot	08/17/2017 10:16:48		Reboot
ioccaenhv_HVFTOF5	clonioc2.jlab.org	11 days, 04:12:46	965566		Reboot	08/15/2017 10:55:07		Reboot
ioccaenhv_HVFTOF6	clonioc2.jlab.org	12 days, 01:01:12	1040472		Reboot	08/14/2017 14:06:41		Reboot
ioccaenhv_HVMVT	clonioc2.jlab.org	7 days, 17:09:01	666541		Reboot	08/18/2017 21:58:52		Reboot
ioccaenhv_HVBLINE	clonioc2.jlab.org	12 days, 03:28:44	1049323		Reboot	08/14/2017 11:39:10		Reboot
ioccaenhv_HVCTOF0	clonioc2.jlab.org	1 day, 01:28:14	91693		Reboot	08/25/2017 13:39:40		Reboot
ioccaenhv_HVFTAG	clonioc2.jlab.org	27 days, 03:22:01	2344921		Reboot	07/30/2017 11:45:52		Reboot
ioccaenhv_HVBICH0	clonioc2.jlab.org	5 days, 03:16:58	443817		Reboot	08/21/2017 11:50:55		Reboot

FIG. 6: The primary IOC health screen, showing hostnames, uptimes, heartbeats, and buttons to restart each IOC. Note the tabs at the top to show different subsets of IOCs (corresponding to the same subsets in the heartbeats screen in Figure 5).

Table I for a list of motors and their corresponding IOC.

classc1	classc4
Collimator	Beam Stopper
Harp 2C21	Beam Viewer
Harp 2C24	
Harp 2H01	
Møller Target	

TABLE I: Stepping motors on two VME IOCs in Hall B.

IV. High Voltage

The largest controls system in Hall B in terms of number of channels is high voltage (HV), with over 20 CAEN mainframes including SY527, SY1527, and SY4527 models. An overview screen of the status of all HV in Hall B is accessible from the HV button in the main CLAS12 menu as shown in Figure 7. Clicking on a detector in this overview screen will bring up the HV controls for that detector (also accessible under each detector's button in the main menu).

Alarm conditions for HV, as displayed in the alarm handler, are explained in Table II. Possible hardware errors and their labels in tabular HV screens are explained in Table III. For the more expert operations of saving and restoring settings, see Appendix A.

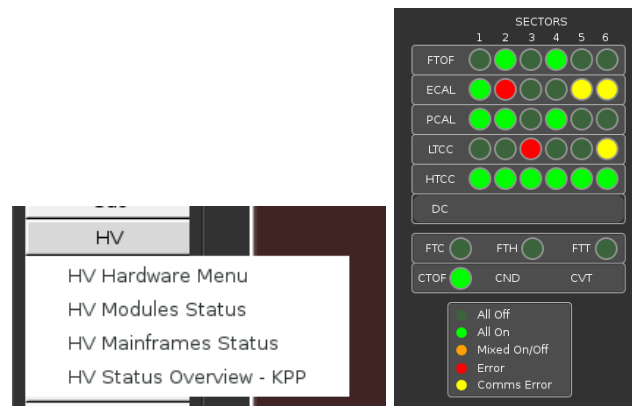


FIG. 7: Access to the HV overview screen from the main menu (left). Clicking on a detector's name in the overview screen (right) will open its HV controls screen.

Status	Severity	Cause
HIHI	MAJOR	Hardware error (e.g. tripped, see Table III)
HIGH	MINOR	Measured voltage above setpoint
LOW	MINOR	Measured voltage below setpoint
LOLO	MAJOR	Hardware communications error

TABLE II: High Voltage alarm conditions in Hall B, where status and severity are displayed in the alarm handler.

Label	Bit	Explanation
OFF	N/A	OFF
ON	0	ON
RUP	1	Ramping Up
RDN	2	Ramping Down
OVC	3	Over Current
OVV	4	Over Voltage
UVV	5	Under Voltage
ExTrip	6	External Trip
MAXV	7	Max Voltage
ExDis	8	External Disable
InTrip	9	Internal Trip
Calib	10	Calibration Error
ChUnplug	11	Unplugged
OVP	13	Over Power
PwFail	14	Power Failure
TempErr	15	Temperature Error

TABLE III: CAEN High Voltage hardware statuses, with their “Label” as displayed in detailed tabular control screens. All but the first 4 rows are considered hardware errors for alarm purposes.

V. Strip Charts

There are two applications available for plotting time histories of slow controls variables: StripTool and MyaViewer. Both are available from the *Strip Charts* button at the bottom of the main CLAS12 controls menu as shown in Figure 8.

The suggested tool for online operations in Hall B is StripTool, which has no access to archived data but is very robust and stable. MyaViewer is necessary for expert studies and can access the Mya archive used to store previous years of Hall B controls data. In either case, configuration files are loadable from their user interfaces to view a predetermined set of variables, or else you can choose any process variable to plot.

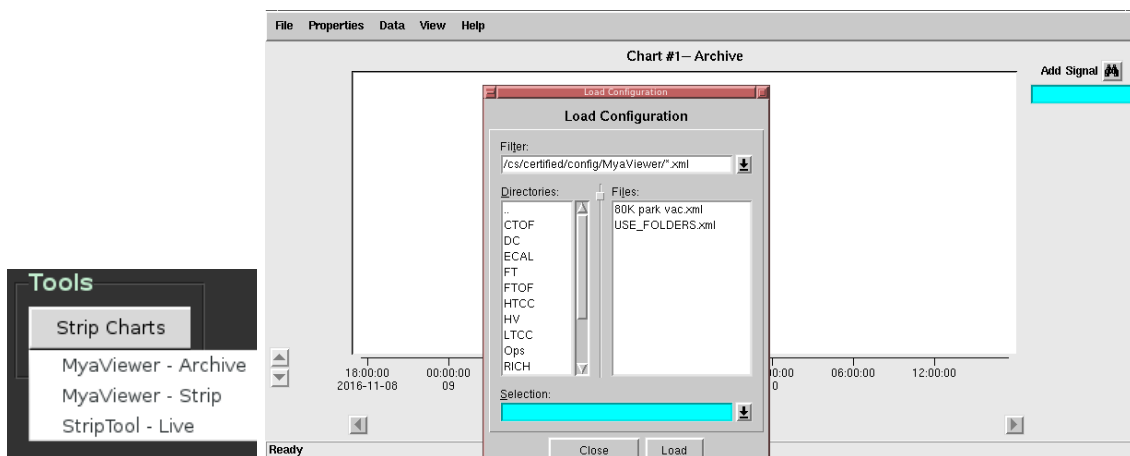


FIG. 8: Utilities for plotting time histories of slow controls variables are accessible from the *Tools* section of the CLAS12 main menu (left). An example of running MyaViewer and opening a preset configuration file via the *File* → *Load Config* menu is shown on right.

VI. Logbook Entries and Screenshots

We use the JLab logbook system, and the primary Hall B logbook is called HBLOG and accessible in a web browser at

<https://logbooks.jlab.org/book/HBLOG>

In Hall B there are two primary methods for adding content to the logbook:

1. Use the web browser interface after logging in with your personal CUE credentials. That is the normal method used for filling out the shift checklist, updating a shift summary log entry, following up with comments on previous log entries, or adding more complex log entries.

2. Use our Hall B GUI that facilitates taking screenshots and quickly sending them to the HBLOG logbook as `user=clasrun`. This is accessed via the “logbook entry” item from the desktop menu, or via the following script in a terminal:

```
logbookEntry.sh
```

This is also the preferred method for taking screenshots and will always save them in `$HOME/screenshots` with timestamped filenames. See Figure 9 for details.

Note, the integrated logbook entry feature in CS-Studio (accessible by right-clicking in any CS-Studio screen) is currently NOT supported.

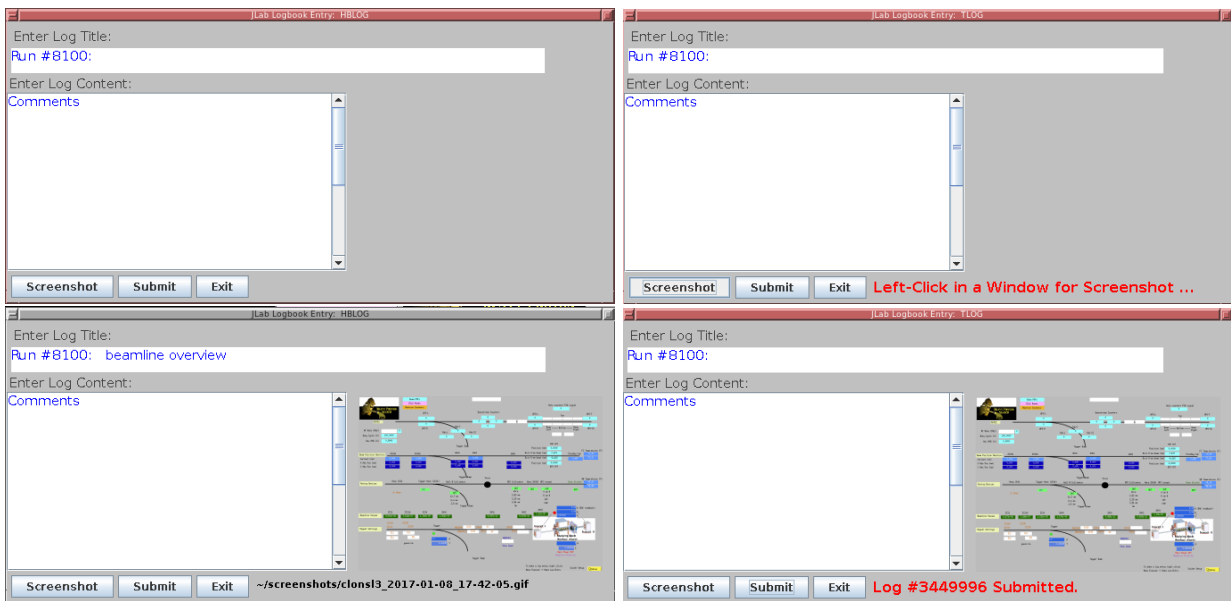


FIG. 9: Upon first opening the logbook/screenshot GUI (top left), only the log title has been automatically initialized (with the current run number). After clicking the “Screenshot” button (top right), it is waiting for you to left-click in the window you desire to capture (clicking the desktop instead of a window will capture the entire desktop). After taking a screenshot (bottom left), a snapshot of the image and its filename on disk are automatically displayed. Note that the “Screenshot” button can be used repeatedly to change the screenshot if you do not like the previous result, or just want to take more screenshots. The “Submit” button can be used to generate an entry in the HBLOG logbook, and after success the entry number will be displayed (bottom right).

VII. Paging System Experts

Paging on-call experts is available from the main CLAS12 controls menu via the *Page Experts* button at the very top of the screen (see Figure 1). This will open a

dropdown menu to choose the desired subsystem, and then open a new window in which to enter a message to be sent to the corresponding expert, as illustrated in Figure 10.

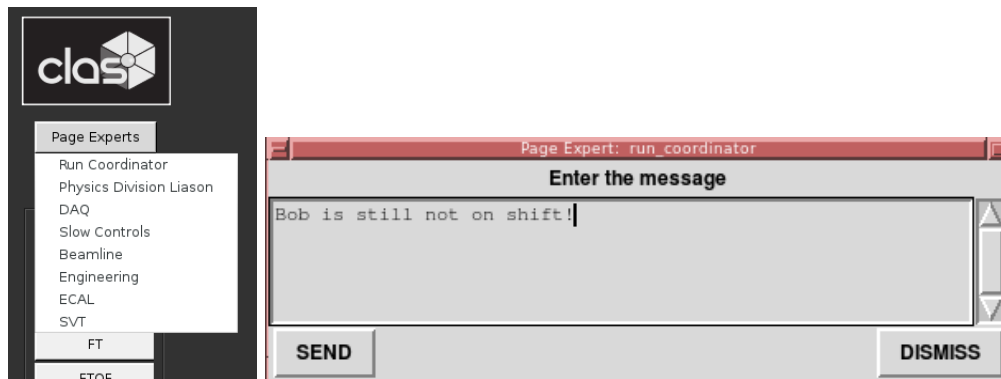


FIG. 10: The dropdown menu for choosing which expert to page (left) and the resulting dialog window in which to enter the message contents (right).

VIII. Slow Controls Contacts

The individuals to be contacted for Hall B slow controls are shown in Table IV. The first point of contact for shift operations is always the on-call controls expert, accessible from the paging system described in Section VII of this document and the phone number in the first row of Table IV. Additional contacts are listed in the table as a fallback.

On-Call	757-748-6922		
	Nathan Baltzell	757-259-5902	baltzell@jlab.org
General	Ken Livingston		kliv@jlab.org
	Wesley Moore	757-259-6033	wmoore@jlab.org
	Bryan McKinnon		mckinnon@jlab.org

TABLE IV: Hall B slow controls contacts.

IX. Remote Usage

There are separate server-grade machines for remote controls access, all with access to the same software and running the same operating system as the desktops in the counting house. For access outside the counting house, login to the server clonsl2. *In order to avoid heavily load on the machines used by counting house shift workers, it is important to not run on clonpc desktops remotely.* All controls computers are behind JLab's hallgw gateway and require 2-factor authentication for remote access.

X. Accelerator Screens

The accelerator's screens are accessed from the main CLAS12 menu via the *JMenu* button (see Figure 11). This uses the hbops account on h1b100, a machine owned and maintained by the accelerator group. If a prompt requests a username, password, or terminal type, just press *Enter*. The location of the button on the CLAS12 menu and the JMenu screen that should appear are shown in Figure 11.

Note it is best to only have one instance of JMenu running. Multiple instances have been known to result in frozen JMenus.

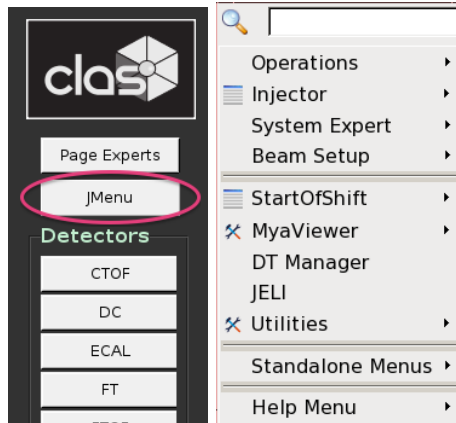


FIG. 11: The location of the button to access the accelerator screens from the CLAS12 controls menu (left) and the resulting accelerator JMenu main screen (right).

A. Tagger

To open the accelerator's controls for the Tagger magnet, from the main JMenu screen (Figure 11) navigate:

Operations → Magnets → Hall B Tagger

The tagger screen is shown in Figure 12.

B. FSD

To open the accelerator's main screen for the fast shutdown system:

Operations → FSD → FSD Overview (Multi-Tree)

From, there you can access the Hall B 2H001 FSD via:

2H001 → Hall B HPS Halo Counters (new) (Collimator) → User Screen

The 2H001 FSD screens are shown in Figure 13

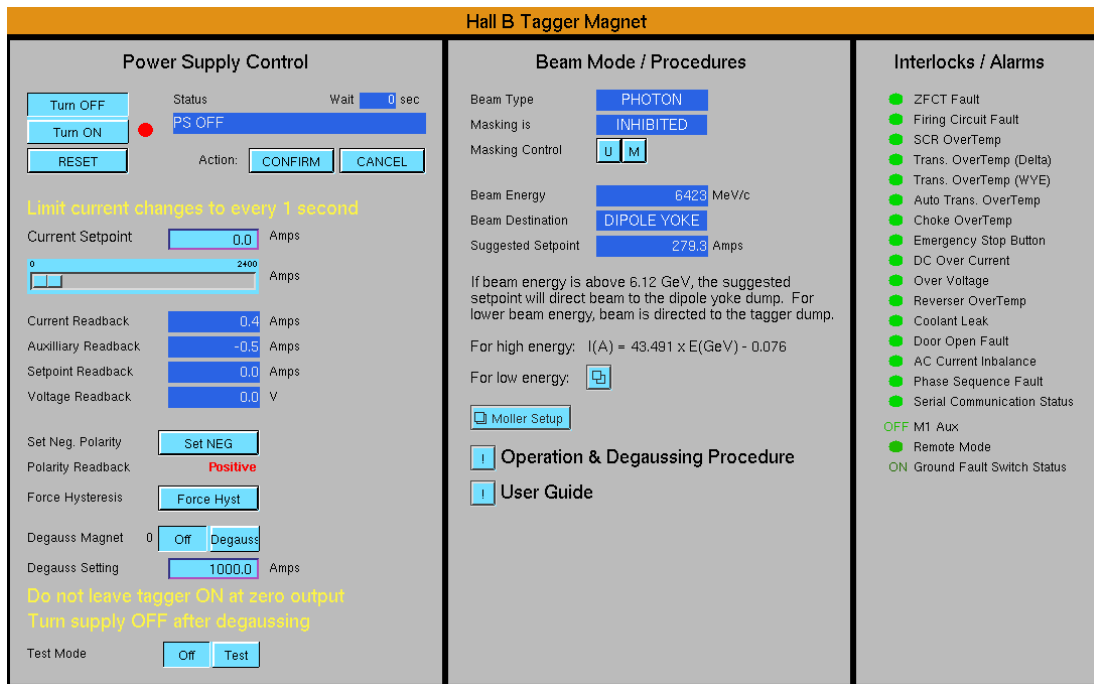


FIG. 12: The accelerator's Hall B Tagger magnet controls.

C. Beam Viewers

The accelerators cameras are accessible from *JMenu* via

Operation → *Viewers* → *Cross Point Switcher* → *Xpt Switcher*

which opens the screen in Figure 14. From there, the Hall B viewer is accessible via buttons:

→ (“Hall B Video - Live” button) ! → live BC4 (ffplay)

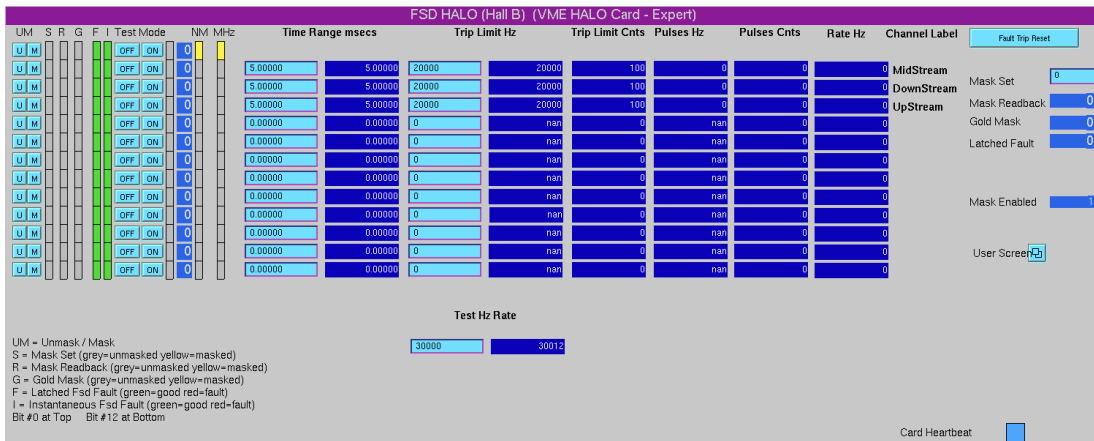
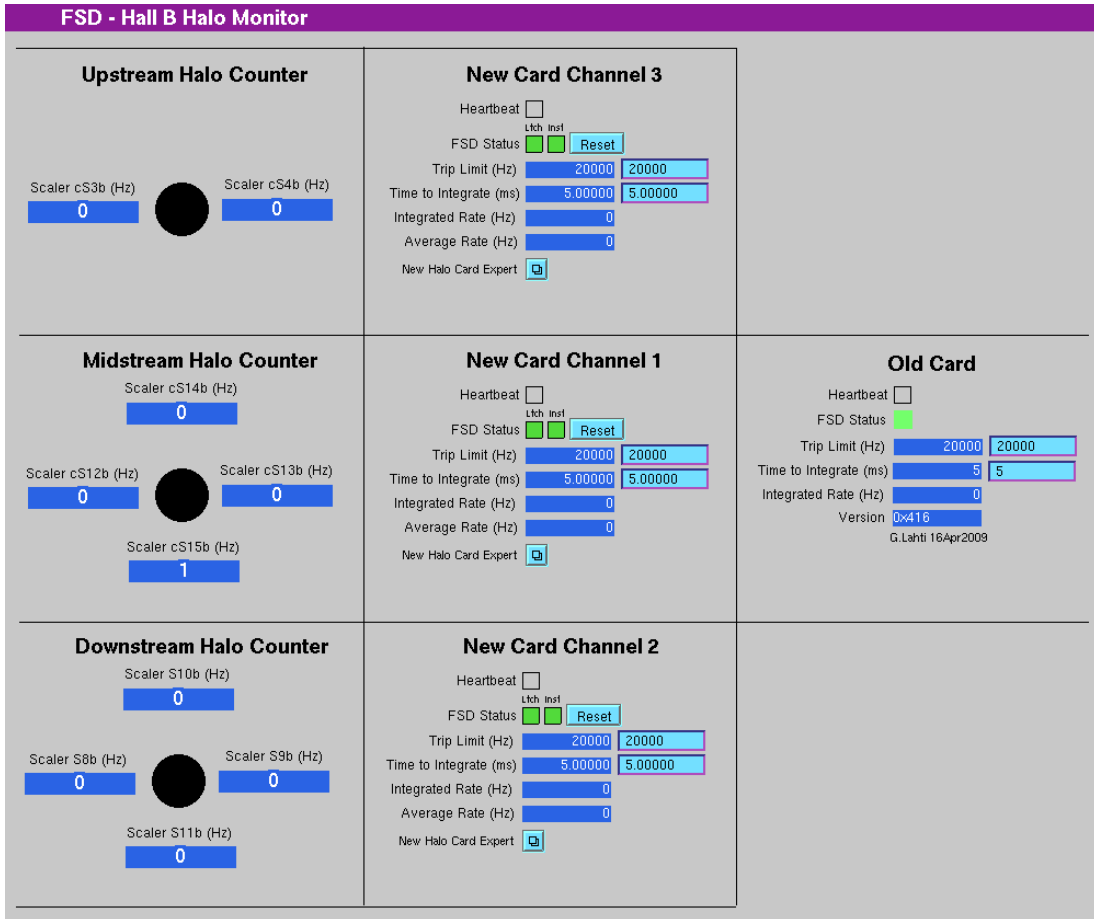


FIG. 13: The user (top) and expert (bottom) Hall B 2H001 FSD screens.

Crosspoint Video Control (Wall and Blue Cherry)

Inputs

1

2

Bluecherry
Username: alarms
Password : alarms1

If logging onto the client
for first time:

host: opsdvr
port: 7001

(Freeman 2016-01-26)

Outputs	Off	Source	Live	Snap	Record
BC Channel 1	OFF	Accel Viewers	<input type="button" value="!"/>	<input type="button" value="!"/>	<input type="button" value="!"/>
BC Channel 2	OFF	Hall D Video	<input type="button" value="!"/>	<input type="button" value="!"/>	<input type="button" value="!"/>
BC Channel 3	OFF	1C12 SLM	<input type="button" value="!"/>	<input type="button" value="!"/>	<input type="button" value="!"/>
BC Channel 4	OFF	Hall B Video	<input type="button" value="!"/>	<input type="button" value="!"/>	<input type="button" value="!"/>

Wall 1	OFF	Accel Viewers
Wall 2	OFF	
Wall 3	OFF	
Wall 4	OFF	
Wall 5	OFF	
Wall 6	OFF	
Wall 7	OFF	
Wall 8	OFF	

Client Controls (Bluecherry)

Web Interface (Bluecherry)

Related Screens

Other Related Scripts

Expert Help

FIG. 14: Access to the accelerator's live beam viewers. The button for the Hall B viewer is circled in red.

Appendices

A. Burt Save/Restore

High voltage settings are saved and restored using burt.

```
/usr/cls12/DATA/burt/
```

A graphical interface to save/restore is accessible from detector's own screens in CS-Studio, where an example for is shown in Figure 15. When saving a new file, this interface chooses filenames based on the current timestamp but allows for the user to modify the name before saving. Detector experts can also generate files in the proper format (see Figure 16) and place them in their detector's subdirectory, and then use the same interface to restore from them.

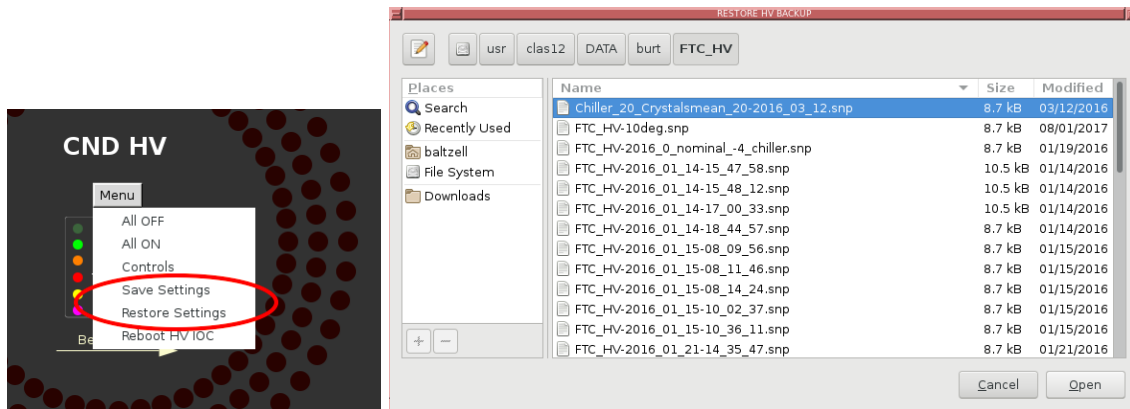


FIG. 15: Access to graphical interface for burt save/restore (left); this example is from the CND screen. Example of save/restore file list as presented for FTC (right).

```
--- Start BURT header
Time:      Sun Nov  5 08:33:40 2017
Login ID:  baltzell (Nathan Baltzell)
Eff  UID:  4865
Group ID:  146
Keywords:
Comments:  CND at 60 Volts.
Type:      Absolute
Directory  /home/baltzell
Req File:  /usr/clas12/release/1.3.0/epics/tools/burtreq/CND_HV.req
--- End BURT header
B_DET_CND_HV_Inner_Seg01_E1:vset 1 6.00000e+01
B_DET_CND_HV_Inner_Seg01_E2:vset 1 6.00000e+01
B_DET_CND_HV_Inner_Seg02_E1:vset 1 6.00000e+01
```

FIG. 16: Example of a burt snapshot header format.