

DCS Readiness for early commissioning

Deshitha Dhammage (University of Colombo (LK))

Ilaria Vai (Universita e INFN (IT))

On behalf of the DCS team

September 3, 2019





Readiness of the DCS – Current Design

GEM Detector Control System ON OFF/STANDBY RAMPING ERROR EXCLUDED Wed 25-Sep-2019 5:46:40 PM ddhammag as:GEM_expert Settings

Status **GAS** **LHC Info** **Magnet Info** **DSS Info**

Kill

Recipe

Save/ Load Recipe

Alarms

Alarms

CLR LV Alarm

Power Cycle

Power Cycle LV

SCAN

LV Scan

HV Scan

FSM

System	State
GEM_ENDCAP Plus :	STANDBY
GEM_ENDCAP_Minus	STANDBY

GEM ENDCAP Plus	State
GEM_LV	ON
GEM_HV	STANDBY
GEM Gas System	RUNNING

GEM ENDCAP Minus	State
GEM_LV	ON
GEM_HV	STANDBY
GEM Gas System	RUNNING

Radiation Monitor

Temp (Rth): C

REM250 : Gy

REM130 : Gy

BPW34S : n/cm2 *10^-12

SI-1 : n/cm2 *10^-12

Endcap Plus HV Endcap Minus HV LV Temperatures

DRIFT	1-36
G1 TOP	1-36
G1 BOT	1-36
G2 TOP	1-36
G2 BOT	1-36
G3 TOP	1-36
G3 BOT	1-36

Messages

HV Main Frame Status

- Main Frame 1
- ENDCAP Plus
- Main Frame 2
- Main Frame 3
- ENDCAP Minus
- Main Frame 4

GAS Status

- Mixer
- RACK 1
- RACK 2

LV Status



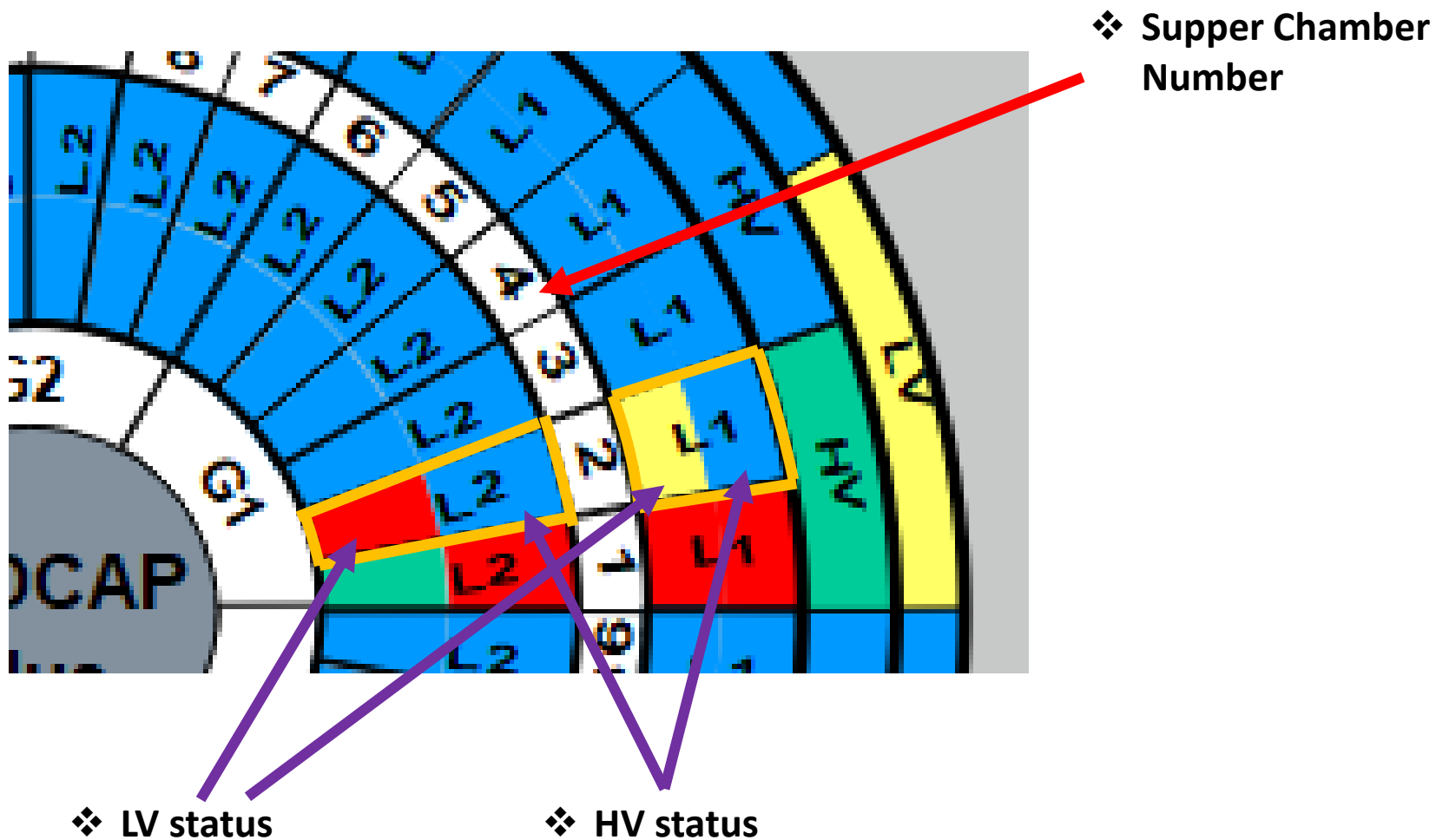
Readiness of the DCS – Current Design

The screenshot displays the GEM Detector Control System interface with several key components:

- Flow Cell status:** A circular status ring for the ENDCAP Plus section, showing HV and LV board statuses for various cells.
- Chamber status:** A circular status ring for the ENDCAP Minus section, showing HV and LV board statuses for various cells.
- HV board status:** A panel showing the status of HV Main Frames (Main Frame 1-4) and Gas Racks (Mixer, RACK 1, RACK 2).
- LV board status:** A panel showing the status of LV Main Frames, LV Branch Controllers (1-4), 48 V Power Modules (1-8), and EASY Crates (1-8).
- FSM (Finite State Machine):** A table showing the state of various systems:

System	State
GEM_ENDCAP Plus	STANDBY
GEM_ENDCAP Minus	STANDBY
GEM ENDCAP Plus	
GEM_LV	ON
GEM_HV	STANDBY
GEM Gas System	RUNNING
GEM ENDCAP Minus	
GEM_LV	ON
GEM_HV	STANDBY
GEM Gas System	RUNNING
- GEM Foil status:** A grid showing the status of foils for G1, G2, and G3 TOP and BOT across 36 positions.
- Temperatures:** A grid showing temperature readings for various components.
- Radiation Monitor:** A panel showing radiation levels: Temp (Rth): C, REM250: Gy, REM130: Gy, BPW34S: n/cm2 '10+12, SI-1: n/cm2 '10+12.

DCS – Chamber Status





DCS – Popup Panels

GEM Detector Control System ON OFF/STANDBY RAMPING ERROR EXCLUDED Wed 25-Sep-2019 5:46:40 PM ddhammag as:GEM_expert Settings

Status **GAS** **LHC Info** **Magnet Info** **DSS Info**

Kill

Recipe

Save/ Load Recipe

Alarms

Alarms

CLR LV Alarm

Power Cycle

Power Cycle LV

SCAN

LV Scan

HV Scan

GE+1/1 HVBrd1 ON Change Settings

HV Board Status RAMPING Last Updated 2018.10.17 13:04

Super Chamber No 1, Layer1 & Layer2	Ch 0	Ch 1	Ch 2	Ch 3	Ch 4	Ch 5	Ch 6
V	200	336	256	412	854	891	2145
C	0.300	0.844	1.244	1.756	2.200	2.656	2.711

Super Chamber No 2, Layer1 & Layer2

Ch 7	Ch 8	Ch 9	Ch 10	Ch 11	Ch 12	Ch 13
V	0	0	0	0	0	0
C	0.000	0.000	0.000	0.000	0.000	0.000

Status Monitor Show Trends Alarm Screen

GE+1/1/01/1 ERROR Change Settings

High Voltage (HV) ERROR Last Updated 2018.10.03 14:53

DRIFT	G1TOP	G1BOT	G2TOP	G2BOT	G3TOP	G3BOT
V	2145	891	854	412	256	338
C	2.711	2.656	2.200	1.756	1.244	0.844

Low Voltage (LV) ON Last Updated 2018.10.17 11:45

Voltage: 5.236 Current: 0.499995

Temperature

1	2	3	4	5	6
loading	loading	loading	loading	loading	loading

Status Monitor Show Trends Alarm Screen

FSM

System	State
GEM_ENDCAP Plus :	STANDBY
GEM_ENDCAP_Minus	STANDBY

GEM ENDCAP Plus	State
GEM_LV	ON
GEM_HV	STANDBY
GEM Gas System	RUNNING

GEM ENDCAP Minus	State
GEM_LV	ON
GEM_HV	STANDBY
GEM Gas System	RUNNING

Radiation Monitor

Temp (Rth): C

REM250 : Gy

REM130 : Gy

BPW34S : n/cm2 *10^-12

SI-1 : n/cm2 *10^-12

Endcap Plus HV **Endcap Minus HV** **LV** **Temperatures**

DRIFT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
G1 TOP																																					
G1 BOT																																					
G2 TOP																																					
G2 BOT																																					
G3 TOP																																					
G3 BOT																																					

GE+1/1-01/DRIFT ON Last Updated 2018.10.17 11:44

OvC OvV UnV Trip CHON

Vmon: 2145.2 Imon: 2.711084

HV Main Frame Status **GAS Status** **LV Status**

GE1/1 MFrame01 STANDBY Last Updated 2018.09.05 17:36

AC Status: Primary PS: Communication: 2

OvC UnV OvV OvT FanFail CHON

Fan 1	Fan 2	Fan 3	Fan 4	Fan 5	Fan 6
error	error	ok	ok	ok	ok
speed	0.0	0.0	0.0	0.0	0.0

LV Main Frame **LV Branch Controllers** **48 V Power Modules** **EASY Crates**

GE1/1 PwrSp3 STANDBY Last Updated 2018.08.14 14:35

Main PwS: 48 V PwS: ok ok

12 V PwS: 17 V PwS: ok ok

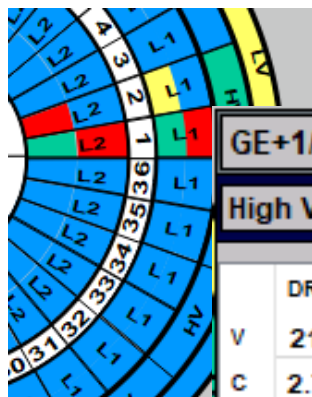
Power Converter 1 Power Converter 2 Power Converter 3 Power Converter 7 Power Converter 8

EASY Crate 1 EASY Crate 2 EASY Crate 3 EASY Crate 4 EASY Crate 5 EASY Crate 6 EASY Crate 7 EASY Crate 8

DCS – Popup Panels

❖ Overall Chamber Status

❖ Single click on chamber to read LV, HV and Temperature values (child panel will open)



GE+1/1/01/1 **ERROR** [Change Settings](#)

High Voltage (HV) **ERROR** Last Updated 2018.10.03 14:53

	DRIFT	G1TOP	G1BOT	G2TOP	G2BOT	G3TOP	G3BOT
V	2145	891	854	412	256	338	200
C	2.711	2.656	2.200	1.756	1.244	0.844	0.300

Low Voltage (LV) **ON** Last Updated 2018.10.17 11:45

Voltage Current

Temperature Last Updated 2018.08.15 14.23

1	2	3	4	5	6
loading	loading	loading	loading	loading	loading

[Status Monitor](#) [Show Trends](#) [Alarm Screen](#)

❖ Change Settings panel will open

❖ HV Status

❖ LV Status

❖ Status Monitor panel will open

❖ Show Trends panel will open

❖ Alarm Screen will open



DCS – HV/LV Monitoring Panels

❖ HV Board Status

❖ HV Channel Status

❖ Show Trend page

❖ User can move to Settings panel

Monitor (dist_1 - gem1; #1)

MONITORING Chamber Name: ON OFF/ STANDBY RAMPING ERROR EXCLUDED Settings Close

HV Board Status

HV Board ID: **GE+1/1 HVBrd01**

Show Trendpage UnderTemp OverTemp

OpMode: FALSE BdStatus: 2 ramping up

readback setting: OpMode = FALSE = Free
OpMode = TRUE = GEM

Board Dp: CAEN/GEM_CAEN_HV_01/board00

	OvC	OvV	UnV	Trip	Status
Drfit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1 on
G1Top	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	16 overvoltage
G1Bot	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	8 overcurrent
G2Top	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	4 ramping down
G2Bot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	0 standby/off
G3Top	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	32 undervoltage
G3Bot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1024 calibration error

STATUS

Status	Meaning
0	off
1	on
2	ramping up
4	ramping down
8	overcurrent
16	overvoltage
32	undervoltage
64	external trip
128	max v
256	external disable
512	internal trip
1024	calibration error
2048	unplugged

UNITS

Dimension or parameter	Unit
Voltage	V
Current	uA
Ramp up/down	V/s
Triptime	s

Show Trendpage

iMonRange = FALSE = High
ZCAdjust = FALSE = Dis
ZCDetect = FALSE = Off
OpMode = FALSE = Free

	V0	I0	Vmon	Imon	OnOff readBack	OnOff Actual	V1	I1	RUP	RDWN	TripTime	onOrder	offOrder	iM Range	ZC Adjust	ZC Detect	vMax SoftValue	iMon Det	iMon Real	Temp	
Drfit	0.0	0.00	2145.2	2.71	Off	On	0.0	0.00	0	0	0	0	0	FALSE	FALSE	FALSE	0	0	0	0	Drfit
G1Top	0.0	0.00	891.2	2.66	Off	Off	0.0	0.00	0	0	0	0	0	FALSE	FALSE	FALSE	0	0	0	0	G1Top
G1Bot	0.0	0.00	854.2	2.20	Off	Off	0.0	0.00	0	0	0	0	0	FALSE	FALSE	FALSE	0	0	0	0	G1Bot
G2Top	0.0	0.00	412.3	1.76	Off	Off	0.0	0.00	0	0	0	0	0	FALSE	FALSE	FALSE	0	0	0	0	G2Top
G2Bot	0.0	0.00	256.1	1.24	Off	Off	0.0	0.00	0	0	0	0	0	FALSE	FALSE	FALSE	0	0	0	0	G2Bot
G3Top	0.0	0.00	338.3	0.84	Off	Off	0.0	0.00	0	0	0	0	0	FALSE	FALSE	FALSE	0	0	0	0	G3Top
G3Bot	300.0	0.26	200.0	0.30	On	Off	0.0	0.00	0	0	0	0	0	TRUE	FALSE	FALSE	0	0	0	0	G3Bot

readback setting actual readback setting actual

LV Board Status

LV Board ID: **GE+1/1 LVBrd01**

BdStatus: 1 on Show Trendpage

Board Dp: CAEN/GEM_CAEN_LV/branchController00/easyCrate0/easyBoard00

LV Channel	V0	I0	Vcon	Vmon	Imon	OnOff readBack	OnOff Actual	V1	I1	TripTime	vMax SoftValue
LV Channel	0.000	0.000	0.000	5.236	0.500	On	On	0.000	0.000	0	0

readback setting actual readback setting

LV Channel	OvC	OvV	UnV	Trip	Status
LV Channel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1 on

Move Cursor Over "Drift", "G1Top", etc. to See Corresponding Channel Dp

❖ LV Board Status

❖ LV Channel Status



DCS – HV/LV Settings Panels

- ❖ Need Expert access to change values
- ❖ Others can only view

❖ HV board DP name

❖ Chamber ID

❖ User can move to Status monitor panel

Settings (dist_1 - gem1; #1)

CHANGE SETTINGS Chamber Name: **GE+1/1/17/1** Status Monitor

Settings - Common | Settings - More

BOARD settings

Operating Mode: **FREE** Apply **Board Dp: CAEN/GEM_CAEN_HV_01/board00** Close

Channel settings

	OnOff	V0	V1	I0	I1	RUP	RDWN	TripTime	Vmon	Imon	I0 readBack
Drfit	Off	0.0	0.0	0.000	0.000	0	0	0	2145.2	2.7111	0.000
G1Top	Off	0.0	0.0	0.000	0.000	0	0	0	891.2	2.6555	0.000
G1Bot	Off	0.0	0.0	0.000	0.000	0	0	0	854.2	2.2000	0.000
G2Top	Off	0.0	0.0	0.000	0.000	0	0	0	412.3	1.7555	0.000
G2Bot	Off	0.0	0.0	0.000	0.000	0	0	0	256.1	1.2444	0.000
G3Top	Off	0.0	0.0	0.000	0.000	0	0	0	338.3	0.8444	0.000
G3Bot	On	300.0	0.0	0.255	0.000	0	0	0	200.0	0.3000	0.255
Sum		300.0	(V)	(uA)	(uA)	(V/s)	(V/s)	(s)	5097.2	11.7110	Sum
		(V)							(V)	(uA)	

SWITCH ALL ON (uA) (uA) Set Divider Current to ALL

SWITCH ALL OFF (V) (V) Set Divider Voltage to ALL

Save current settings to... 0.255 (uA) Set i0 to ALL

Load settings from file

Load default values

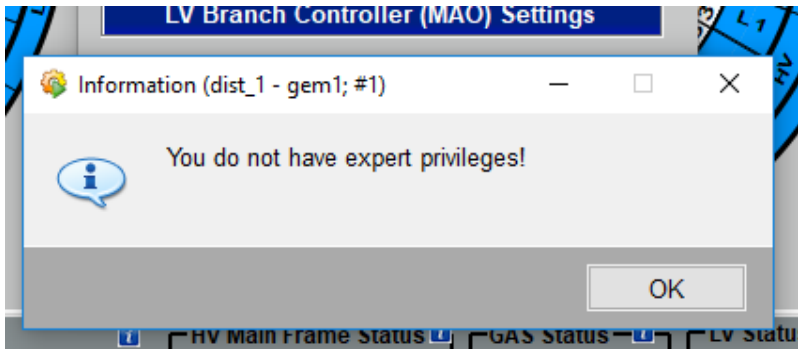
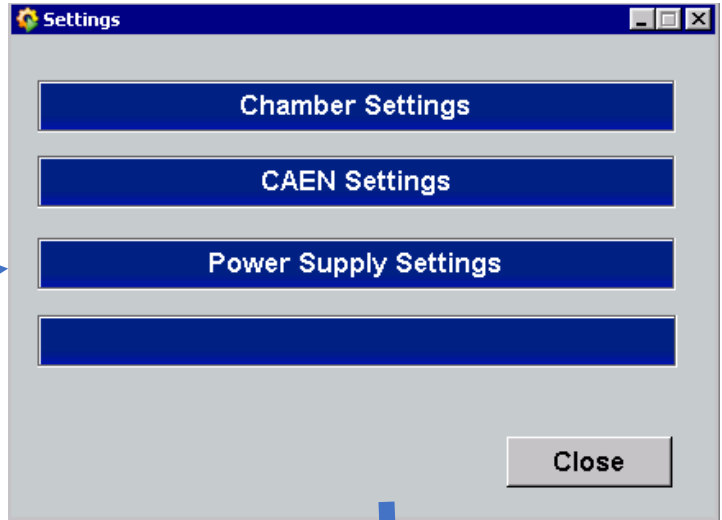
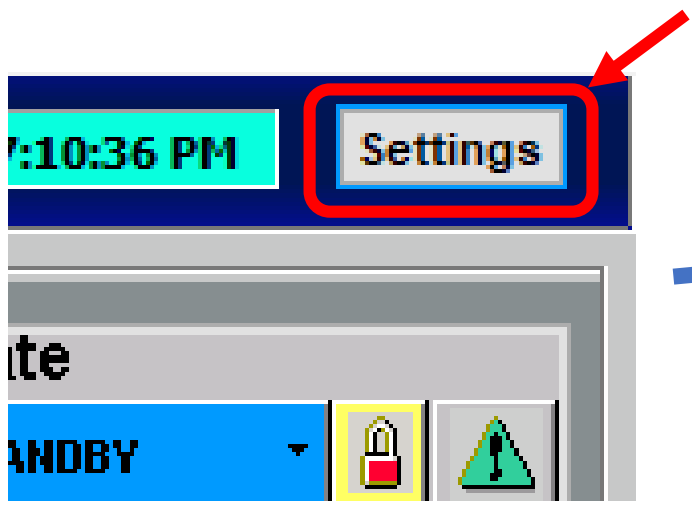
Click "Apply" to apply settings Apply

CAEN/GEM_CAEN_HV_01/board00/channel000

Move Cursor Over "Drift", "G1Top", etc. to See the Corresponding Channel Dp

ON OFF/STANDBY RAMPING ERROR EXCLUDED

❖ Move Cursor over "Drift", "G1Top", etc. to see the corresponding Dp



- ❖ For experts' use only
- ❖ By using this button, experts can,
 - ❖ Include or exclude selected chambers
 - ❖ Control CAEN settings
 - ❖ Chamber power settings

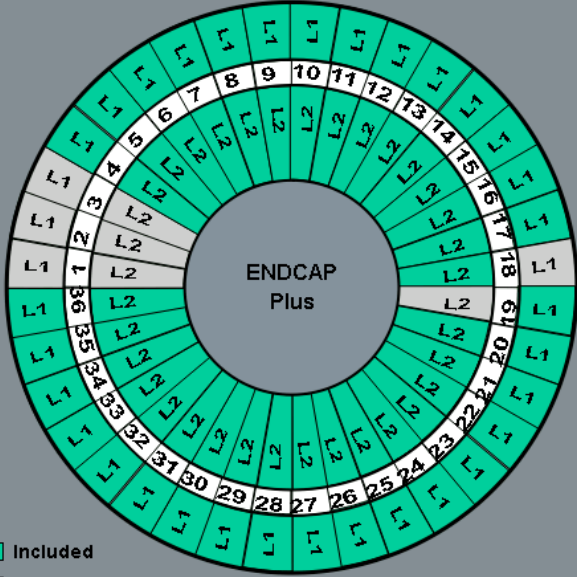
DCS – Chamber Include/ Exclude Panel (experts)

ChamberSettings

ENDCAP Plus | ENDCAP Minus

Supper Chamber	Layer	Status	Enable/ Disable <input type="checkbox"/> ???
GEMINI 16	Layer 1	Included	Exclude
	Layer 2	Included	Exclude
GEMINI 17	Layer 1	Included	Exclude
	Layer 2	Included	Exclude
GEMINI 18	Layer 1	Excluded	Include
	Layer 2	Included	Exclude
GEMINI 19	Layer 1	Included	Exclude
	Layer 2	Excluded	Include
GEMINI 20	Layer 1	Included	Exclude
	Layer 2	Included	Exclude
GEMINI 21	Layer 1	Included	Exclude
	Layer 2	Included	Exclude
GEMINI 22	Layer 1	Included	Exclude
	Layer 2	Included	Exclude

Apply Changes Clear Selection



Close

- ❖ Can be used to “Include” or “Exclude” the chambers from the system
- ❖ It will only block the access user interface
- ❖ Will not change any HV or LV status
- ❖ Later on it will be synchronized with FSM status

DCS – CAEN Status and Setting Panel (experts)

CAENStatus (dist_1 - GE1-1_CMS_GEM_DCS_Final; #1)

CAEN Status Warning - Expert's Use Only Close

HV Status

HV Main Frame

HV Boards

- Main Frame 1: +GE1/1/HVBrd01 - +GE1/1/HVBrd09, +GE1/1/01 - +GE1/1/18
- Main Frame 2: +GE1/1/HVBrd10 - +GE1/1/HVBrd18, +GE1/1/19 - +GE1/1/36
- Main Frame 3: -GE1/1/HVBrd01 - -GE1/1/HVBrd09, +GE1/1/01 - +GE1/1/18
- Main Frame 4: -GE1/1/HVBrd10 - -GE1/1/HVBrd18, -GE1/1/19 - -GE1/1/36

Hardware: SY4527, A1515TG

LV Status

LV Main Frame

LV Branch Controllers

- Branch Controller 1: PCon 1, Channel0, Channel1
- Branch Controller 2: PCon 3, Channel0, Channel1; PCon 4, Channel0, Channel1
- Branch Controller 3: PCon 5, Channel0, Channel1; PCon 6, Channel0, Channel1
- Branch Controller 4: PCon 7, Channel0, Channel1; PCon 8, Channel0, Channel1

48 V Power Modules: A3486S (48 V)

LV Boards

- Branch Controller 1: +GE1/1/LVBrd01 - +GE1/1/LVBrd06, +GE1/1/01 - +GE1/1/18
- Branch Controller 2: +GE1/1/LVBrd07 - +GE1/1/LVBrd12, +GE1/1/19 - +GE1/1/36
- Branch Controller 3: -GE1/1/LVBrd01 - -GE1/1/LVBrd06, +GE1/1/01 - +GE1/1/18
- Branch Controller 4: -GE1/1/LVBrd07 - -GE1/1/LVBrd12, -GE1/1/19 - -GE1/1/36

Hardware: SY4527, A1676A, A3016HP

- ❖ Used to monitor and control hardware in one place
- ❖ Click on each boxes to view the controlling panels (child panel will open)

DCS – Chamber HV/LV Settings Panel (All-in-one) (experts)

Power Supply Settings

ENDCAP Plus | ENDCAP Minus

Supper Chamber	Layer	Select
GE+1/1/27	Layer 1	Click here to select
GE+1/1/28	Layer 1	Click here to select
GE+1/1/29	Layer 1	Click here to select
GE+1/1/30	Layer 1	Selected
GE+1/1/31	Layer 1	Click here to select
GE+1/1/32	Layer 1	Click here to select
GE+1/1/33	Layer 1	Click here to select
GE+1/1/34	Layer 1	Click here to select
GE+1/1/35	Layer 1	Click here to select
GE+1/1/36	Layer 1	Click here to select

Power Supply Settings

Apply HV Settings | Apply LV Settings

Show Current Settings for Selected Chamber | Show Current Settings

ENDCAP Plus

Selected (Red) | Active Chamber (Cyan) | Excluded (Grey)

Clear Selection

Warning - Expert's Use Only

HV Channel settings

	OnOff	V0	I0	vMax SoftValue	RUP	RDWN	TripTime	onOrder	Board Mode
Drfit	Off	718.4	10.000	1000.0	10	10	1	1	FREE
G1Top	Off	279.7	10.000	1000.0	10	10	1	2	
G1Bot	Off	357.6	10.000	1000.0	10	10	1	5	
G2Top	Off	558.7	10.000	1000.0	10	10	1	3	
G2Bot	Off	351.2	10.000	1000.0	10	10	1	6	
G3Top	Off	399.1	10.000	1000.0	10	10	1	4	
G3Bot	Off	335.2	10.000	1000.0	10	10	1	7	
Sum	(V)	2999.9	(uA)	(V)	(V/s)	(V/s)	(s)		

SWITCH ALL ON | SWITCH ALL OFF

Set I0 to ALL | Set Divider Current to ALL | Set Divider Voltage to ALL

Click "Apply HV Settings" to apply HV settings

LV Channel settings

LVChannel	OnOff	V0	I0	TripTime	vMax
	Off	5.000	10.000	1	8.000
		(V)	(A)	(s)	(V)

Click "Apply LV Settings" to apply LV settings

- ❖ Can be used to set HV/LV values to multiple chambers at once
- ❖ Also user can get current HV/LV values of selected chamber
- ❖ User can update selected fields (using radio buttons)

- ❖ Emergency Stop →
- ❖ Recipe →
- ❖ Alarms →
- ❖ Power Cycle LV →
- ❖ Low Voltage Scan →
- ❖ High Voltage Scan →

The screenshot shows the GEM Detector Control System interface. The main area displays a circular diagram of the detector segments, with 'LV' (Low Voltage) and 'HV' (High Voltage) labels. The central part of the diagram is labeled 'ENDCAP Plus'. The interface includes several control buttons and sections:

- Kill** (Red button)
- Recipe** section: Save/ Load Recipe
- Alarms** section: Alarms, CLR LV Alarm
- Power Cycle** section: Power Cycle LV
- SCAN** section: LV Scan, HV Scan
- Bottom navigation: Endcap Plus HV, Endcap Minus HV, LV, Temperatures

❖ Used to power cycle the LV for selected chambers

PNL (dist_1 - gem1; #1)

ENDCAP Plus ENDCAP Minus

Super Chamber	Layer	Voltage	Current	Enable/ Disable
GEMINI 1	Layer 1	5.236	0.500	Click here to select
	Layer 2	0.000	0.278	Click here to select
GEMINI 2	Layer 1	0.000	0.000	Excluded
	Layer 2	0.000	0.000	Click here to select
GEMINI 3	Layer 1	0.000	0.000	Excluded
	Layer 2	0.000	0.000	Click here to select
GEMINI 4	Layer 1	0.000	0.000	Click here to select
	Layer 2	0.000	0.300	Power Cycle
GEMINI 5	Layer 1	0.000	0.178	Power Cycle
	Layer 2	0.000	0.000	Click here to select
GEMINI 6	Layer 1	0.000	0.000	Click here to select
	Layer 2	0.000	0.000	Click here to select
GEMINI 7	Layer 1	0.000	0.000	Click here to select
	Layer 2	0.000	0.000	Click here

Power Cycle LV Clear Selection

Close

Messages

❖ Used to perform LV scan for selected chambers

LvScan (dist_1 - gem1; #1)
— □ ×

ENDCAP Plus
ENDCAP Minus

Supper Chamber	Layer	Select
GEMINI 1	Layer 1	<input type="checkbox"/> Select All Click here to select
	Layer 2	Click here to select
GEMINI 2	Layer 1	Excluded
	Layer 2	Click here to select
GEMINI 3	Layer 1	Excluded
	Layer 2	Click here to select
GEMINI 4	Layer 1	Click here to select
	Layer 2	Click here to select
GEMINI 5	Layer 1	Click here to select
	Layer 2	Click here to select
GEMINI 6	Layer 1	Selected
	Layer 2	Click here to select
GEMINI 7	Layer 1	Selected
	Layer 2	Selected
GEMINI 8	Layer 1	Click here to select
	Layer 2	Click here to select
GEMINI 9	Layer 1	Click here to select
	Layer 2	Click here to select
GEMINI 10	Layer 1	Click here to select
	Layer 2	Click here to select

LV Channel Scan

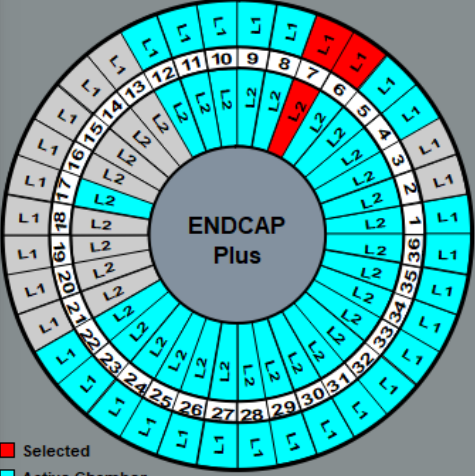
Start Voltage

Step Size Start Scan for Selected Layers

Stop Voltage Stop Scan

Hold Time Decimal Places for Currents

Switch Off Channels After Scan



■ Selected
■ Active Chamber

Supper Chamber	Voltage (V)	Current (A)
GE1/1	4	0.0111
+GEMINI_04	4.5	0.0222
Layer 2	5	0.1222
	5.5	0.133
	6	0.233
	6.5	0.256
	7	0.3
GE1/1	4	0
+GEMINI_05	4.5	0.056
Layer 1	5	0.089
	5.5	0.089
	6	0.156
	6.5	0.167
	7	0.178



DCS – HV Scan Panel

❖ Use to perform HV scan for selected chambers

HvScan (dist_1 - gem1; #1)

ENDCAP Plus ENDCAP Minus

Supper Chamber	Layer	Select
GEMINI 1	Layer 1	Click here to select
	Layer 2	Click here to select
GEMINI 2	Layer 1	Excluded
	Layer 2	Click here to select
GEMINI 3	Layer 1	Excluded
	Layer 2	Click here to select
GEMINI 4	Layer 1	Click here to select
	Layer 2	Click here to select
GEMINI 5	Layer 1	Selected
	Layer 2	Selected
GEMINI 6	Layer 1	Click here to select
	Layer 2	Click here to select
GEMINI 7	Layer 1	Click here to select
	Layer 2	Click here to select
GEMINI 8	Layer 1	Click here to select
	Layer 2	Click here to select
GEMINI 9	Layer 1	Click here to select
	Layer 2	Click here to select
GEMINI 10	Layer 1	Click here to select
	Layer 2	Click here to select

HV Channel Scan

Start Voltage

Step Size

Stop Voltage

Hold Time Decimal Places for Currents

Switch Off Channels After Scan

Start Scan for Selected Layers Stop Scan

Legend: ■ Selected ■ Active Chamber

Clear Selection Clear Table Close

Supper Chamber	Drift Voltage (V)	Drift Current (uA)	G1_Top Voltage (V)	G1_Top Current (uA)	G1_Bot Voltage (V)	G1_Bot Current (uA)	G2_Top Voltage (V)	G2_Top Current (uA)	G2_Bot Voltage (V)	G2_Bot Current (uA)	G3_Top Voltage (V)	G3_Top Current (uA)	G3_Bot Voltage (V)	G3_Bot Current (uA)
GE1/1	100	0.1	100	0.6444	100	1.0222	100	1.4555	100	1.9555	100	2.4555	100	100
+GEMINI_04	150	0.1889	150	0.6778	150	1.0778	150	1.5222	150	2	150	2.5222	150	150
Layer 1	200	0.2778	200	0.7444	200	1.0889	200	1.5555	200	2.0666	200	2.5222	200	200
	250	0.3111	250	0.8	250	1.1444	250	1.6	250	2.1444	250	2.6	250	250
	300	0.3889	300	0.8667	300	1.2333	300	1.7	300	2.1778	300	2.6222	300	300
	350	0.4778	350	0.9111	350	1.2555	350	1.7333	350	2.2222	350	2.6222	350	350
	400	0.4778	400	0.9111	400	1.3555	400	1.8111	400	2.3111	400	2.6555	400	400
	450	0.4778	450	0.9222	450	1.3555	450	1.8111	450	2.3333	450	2.7333	450	450
	500	0.5778	500	0.9667	500	1.3667	500	1.8889	500	2.4111	500	2.8	500	500
GE1/1	100	0.0778	100	0.6222	100	1.2222	100	1.7555	100	2.3111	100	2.7666	100	100
+GEMINI_04	150	0.1444	150	0.6889	150	1.3222	150	1.7555	150	2.3222	150	2.8555	150	150
Layer 2	200	0.2444	200	0.7222	200	1.3889	200	1.8444	200	2.3333	200	2.8666	200	200
	250	0.2778	250	0.8111	250	1.4555	250	1.8889	250	2.4222	250	2.9222	250	250
	300	0.2778	300	0.9	300	1.5	300	1.9333	300	2.4222	300	2.9889	300	300
	350	0.3333	350	0.9333	350	1.5444	350	1.9666	350	2.4555	350	3.0111	350	350
	400	0.4	400	1.0111	400	1.6444	400	2.0555	400	2.5222	400	3.0777	400	400
	450	0.4444	450	1.1111	450	1.6778	450	2.1333	450	2.6111	450	3.1444	450	450
	500	0.5333	500	1.2111	500	1.7	500	2.2333	500	2.7	500	3.2444	500	500



DCS – GAS Main Panel

GEM Detector Control System

ON OFF/STANDBY RAMPING ERROR EXCLUDED

Wed 25-Sep-2019 5:46:40 PM

ddhammag as:GEM_expert Settings

Kill

Recipe Save/Load Recipe

Alarms Alarms CLR LV Alarm

Power Cycle Power Cycle LV

SCAN LV Scan HV Scan

Connections

Gas System Status

Communication

Services

Mixer Exhaust

Details

Expert

Mask/Unmask

Acknowledge alarm

Alarm Screen

Alarm Settings

Gas Racks

61 Global Settings See Trends

Flow Cells

Ch_01 Ch_02
GE-1/1/04 - GE-1/1/09 L1 GE-1/1/04 - GE-1/1/09 L2

Ch_03 Ch_04
GE-1/1/10 - GE-1/1/15 L1 GE-1/1/10 - GE-1/1/15 L2

Ch_05 Ch_06
GE-1/1/16 - GE-1/1/21 L1 GE-1/1/16 - GE-1/1/21 L2

Ch_07 Ch_08
GE-1/1/22 - GE-1/1/27 L1 GE-1/1/22 - GE-1/1/27 L2

Ch_09 Ch_10
GE-1/1/28 - GE-1/1/33 L1 GE-1/1/28 - GE-1/1/33 L2

Ch_11 Ch_12
GE-1/1/34 - GE-1/1/03 L1 GE-1/1/34 - GE-1/1/03 L2

Global Status See Trends

Gas Racks

64 Global Settings See Trends

Flow Cells

Ch_01 Ch_02
GE+1/1/04 - GE+1/1/09 L1 GE+1/1/04 - GE+1/1/09 L2

Ch_03 Ch_04
GE+1/1/10 - GE+1/1/15 L1 GE+1/1/10 - GE+1/1/15 L2

Ch_05 Ch_06
GE+1/1/16 - GE+1/1/21 L1 GE+1/1/16 - GE+1/1/21 L2

Ch_07 Ch_08
GE+1/1/22 - GE+1/1/27 L1 GE+1/1/22 - GE+1/1/27 L2

Ch_09 Ch_10
GE+1/1/28 - GE+1/1/33 L1 GE+1/1/28 - GE+1/1/33 L2

Ch_11 Ch_12
GE+1/1/34 - GE+1/1/03 L1 GE+1/1/34 - GE+1/1/03 L2

Global Status See Trends

FSM

System	State
GEM_ENDCAP Plus :	STANDBY
GEM_ENDCAP_Minus	STANDBY

GEM ENDCAP Plus	State
GEM_LV	ON
GEM_HV	STANDBY
GEM Gas System	RUNNING

GEM ENDCAP Minus	State
GEM_LV	ON
GEM_HV	STANDBY
GEM Gas System	RUNNING

Radiation Monitor

Temp (Rth): C

REM250 : Gy

REM130 : Gy

BPW34S : n/cm2 *10-12

SI-1 : n/cm2 *10-12

Endcap Plus HV **Endcap Minus HV** **LV** **Temperatures**

DRIFT	1-36
G1 TOP	1-36
G1 BOT	1-36
G2 TOP	1-36
G2 BOT	1-36
G3 TOP	1-36
G3 BOT	1-36

Messages

HV Main Frame Status

Main Frame 1 ENDCAP Plus
Main Frame 2
Main Frame 3 ENDCAP Minus
Main Frame 4

GAS Status

Mixer
RACK 1
RACK 2

LV Status

LV Main Frame

LV Branch Controllers - 48 V Power Modules - EASY Crates

Main Frame

Branch Controller 1 ENDCAP Plus
Branch Controller 2 ENDCAP Plus
Branch Controller 3 ENDCAP Minus
Branch Controller 4 ENDCAP Minus

Power Converter 1
Power Converter 2
Power Converter 3
Power Converter 4
Power Converter 5
Power Converter 6
Power Converter 7
Power Converter 8

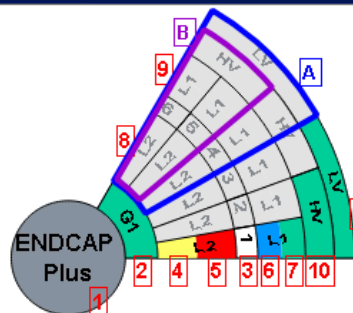
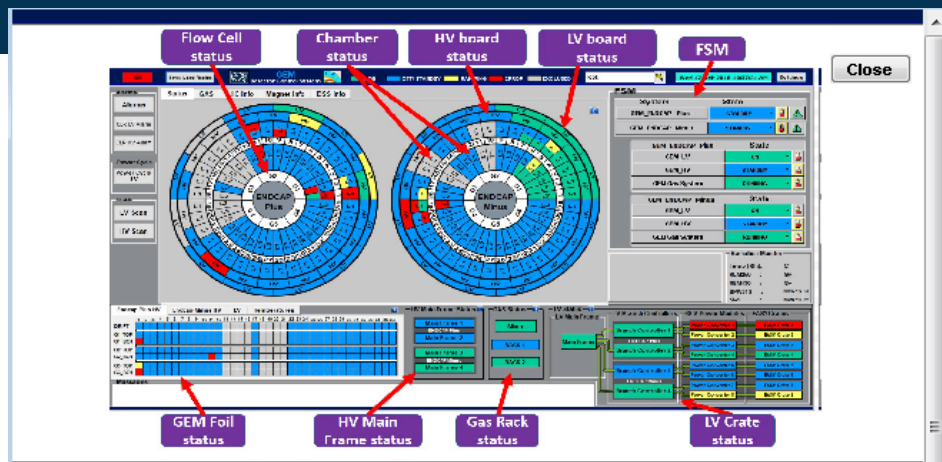
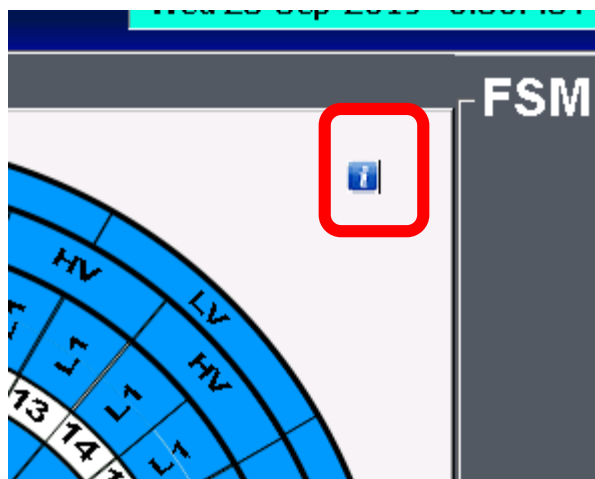
EASY Crate 1
EASY Crate 2
EASY Crate 3
EASY Crate 4
EASY Crate 5
EASY Crate 6
EASY Crate 7
EASY Crate 8



DCS – GAS Main Panel

The screenshot displays the DCS GAS Main Panel interface. The top status bar shows 'Detector Control System' with various operational modes: ON (green), OFF/STANDBY (blue), RAMPING (yellow), ERROR (red), and EXCLUDED (grey). The date and time are 'Wed 25 Sep 2019 5:46'. The main panel is divided into several sections:

- Left Panel:** Contains 'Connections' (Gas System Status, Communication), 'Services' (Mixer, Exhaust), and 'Expert' (Mask/Unmask, Acknowledge alarm, Alarm Screen, Alarm Settings) sections.
- Gas Racks 61:** A callout box labeled 'Gas Rack Status' points to the '61' rack number. Below it, a 'Global Settings' button and a 'See Trends' button are visible.
- Flow Cells (Rack 61):** A grid of 12 flow cells, labeled Ch_01 through Ch_12, each with a corresponding status button. Below the grid are 'Global Status' and 'See Trends' buttons.
- Gas Racks 64:** A callout box labeled 'Gas Rack Settings' points to the '64' rack number. Below it, a 'Global Settings' button and a 'See Trends' button are visible.
- Flow Cells (Rack 64):** A grid of 12 flow cells, labeled Ch_01 through Ch_12, each with a corresponding status button. Below the grid are 'Global Status' and 'See Trends' buttons.
- Bottom Panel:** A callout box labeled 'Gas Channel Status' points to a row of channel indicators (HV, Endcap Minus HV, LV, Temperatures) and a status bar for 'Main Frame 1', 'GAS Status', and 'LV Status'.



- 1 :- Endcap Name ("Plus"/ "Minus")
- 2 :- Gas Status
- 3 :- Supper Chamber Number
- 4 :- Bottom Layer Chamber Low Voltage Status (LV)
- 5 :- Bottom Layer Chamber High Voltage Status (HV)
- 6 :- Top Layer Chamber Low Voltage Status (LV)
- 7 :- Bottom Layer Chamber High Voltage Status (HV)
- 8 :- Bottom Layer Chamber (L2)
- 9 :- Top Layer Chamber (L1)
- 10 :- High Voltage Board (HV)
- 11 :- Low Voltage Board (LV)

(A) - One LV board is connected to 8 Chambers

(B) - One HV board is connected to 4 Chambers

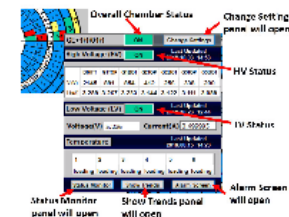
(1) Endcap Name

Indicates the Endcap Name as "Plus" or "Minus" which each wheel belongs to

(2) Gas Status

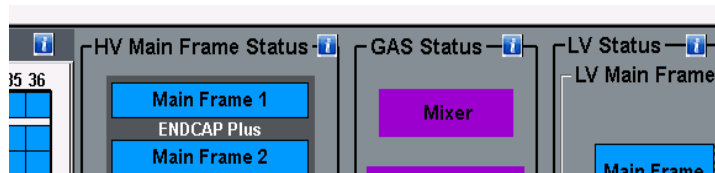
Indicates the gas status of the chamber. Background color of the box will be changed according to the status

Click on gas (G..) box to see status popup panel



(3) Supper Chamber Number

Indicates Supper Chamber Number



DCS experts accessible panels:-

- Configuration of DCS:
 - Include and exclude chambers panels

- Setting parameters
 - Alarm limits setting panels
 - HV /LV value setting and configuration panels
 - Gas limit setting panels

DCS operators accessible panels:-

- Monitoring and Controlling of DCS:
 - Detector monitoring panels
 - Gas monitoring panels
 - HV/LV value settings panels
 - HV/LV scan panels
 - LV power cycle panel
 - Alarm panel

Any user without login:-

- Any user can use monitoring panels without login:
 - Detector monitoring panels
 - Gas monitoring panels
 - HV/LV value settings panels (but not allowed to change the settings)
 - Trending panels

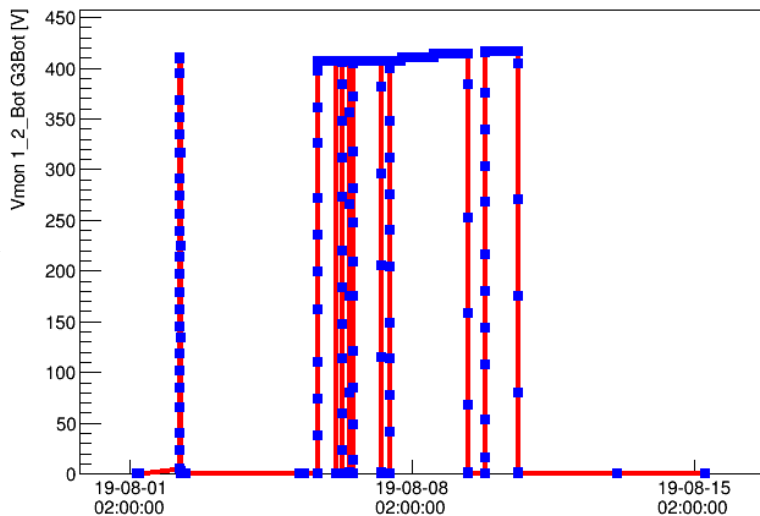
What is available now → tools from QC8:-

- Simone prepared a tool that retrieves data from QC8 DCS database (HV and LV)
- The HV and LV channels are mapped in a python script
- For each channel the voltage applied, the current and the status of the channel are monitored
- A root file with all the plots related to a selected time window is created by the script and is available for analysis



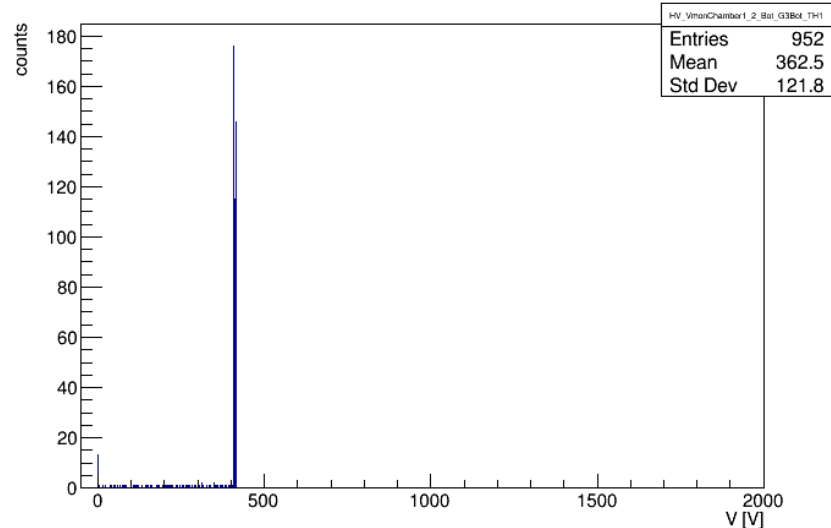
DCS – Offline Monitoring Tools

HV_VmonChamber1_2_Bot_G3Bot.UTC_time

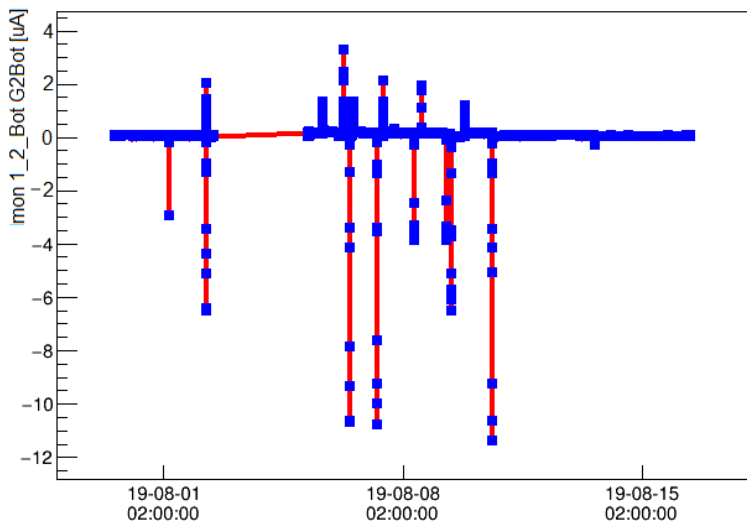


Vmon →

HV_VmonChamber1_2_Bot_G3Bot.TH1

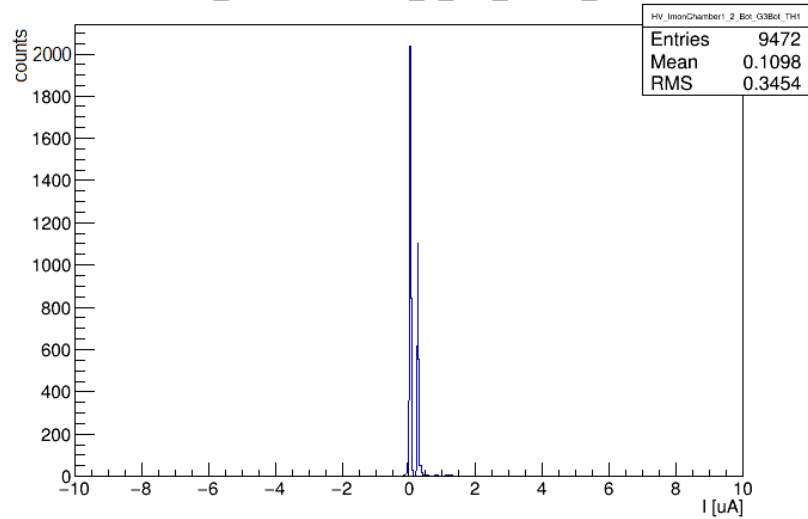


HV_ImonChamber1_2_Bot_G2Bot.UTC_time



Imon →

HV_ImonChamber1_2_Bot_G3Bot.TH1



For Commissioning:-

➤ Tool 1 → Short-term:

- The same tool can be reused for P5, just modifying the mapping of the chambers in the script

➤ Tool 2 → Long-term:

- Online monitoring tool has been developed by RPC people.
- It basically takes data from the DCS DB and produces plots, with possibility of online analysis, in a web page.
- Same tool is going to be readapted for GEM

Standalone tests:-

- Connectivity tests with all the HV, LV and gas channels
 - test the chain cable + DCS before the connection to the chamber to avoid swap/mismatch of the cables w.r.t. DCS mapping
- Perform a test run of DCS without connecting chamber with power supplies
- ConfigurationDB and ConditionDB configuration
 - Check that recipes with standard voltages are correctly retrieved in the ConfigurationDB
 - Check that readout data are correctly stored in the ConditionDB



What we can do with DCS:-

- Can easily operate single chamber at a time
 - commissioning can be proceed chamber by chamber or SC
 - “Include/Exclude” panel can be used
- Monitoring
 - HV/LV boards and channels, gas flow, temperature
 - Temperature of Boards and MAOs, current provided by the MAO both for power both for services
 - Cooling racks and power system racks
 - Trending plots
- Controlling
 - HV/LV boards and channels
 - power system racks

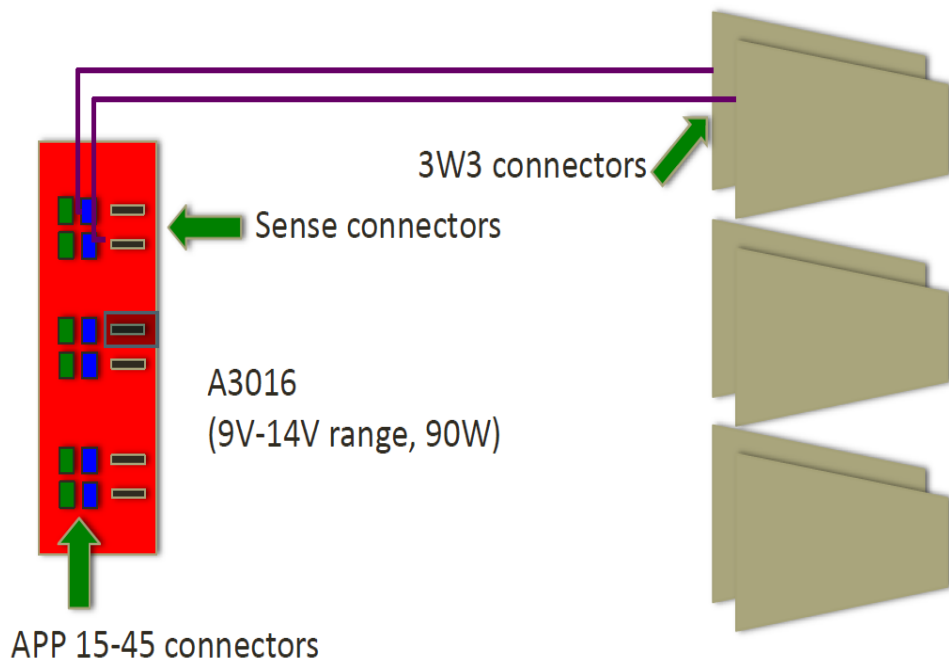
What we can do with DCS:-

- Software protection in case of problem
 - Alarms
 - Kill button
- Storing and archiving
 - All the useful data will be archived and stored in data base
- Retrieve stored data
 - Special monitoring tool to get and display the stored data
- Other useful functions
 - HV/ LV scan panels
 - Can be use to check the chamber power stability
 - LV power cycle panel
 - Can be used to power cycle in case of LV problem

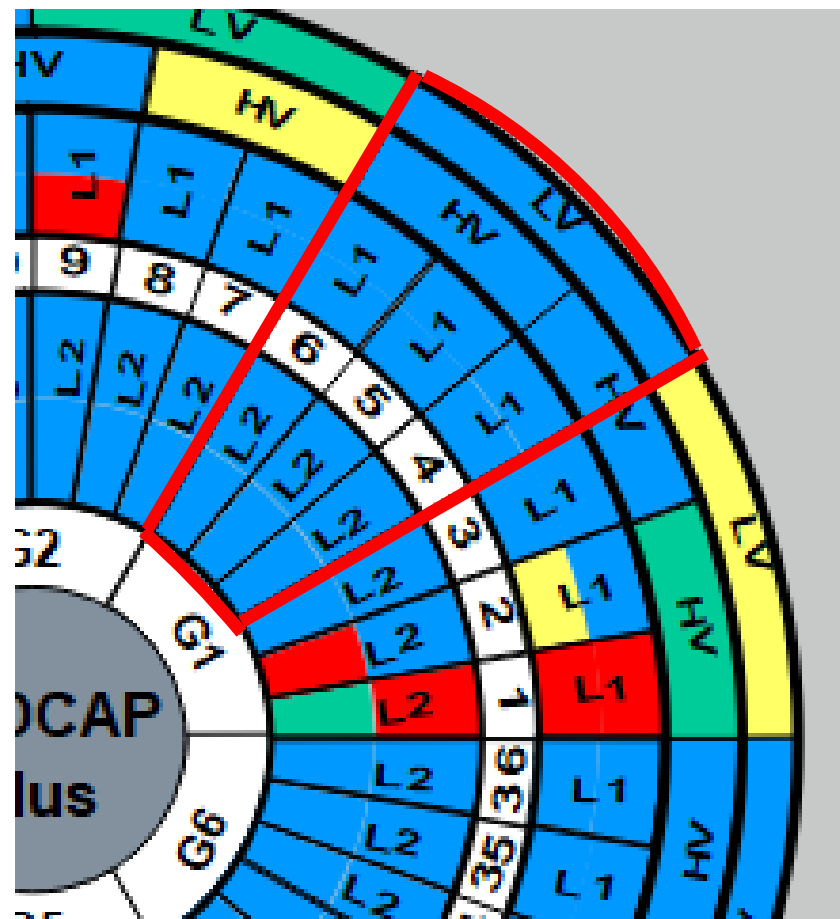


Thank You

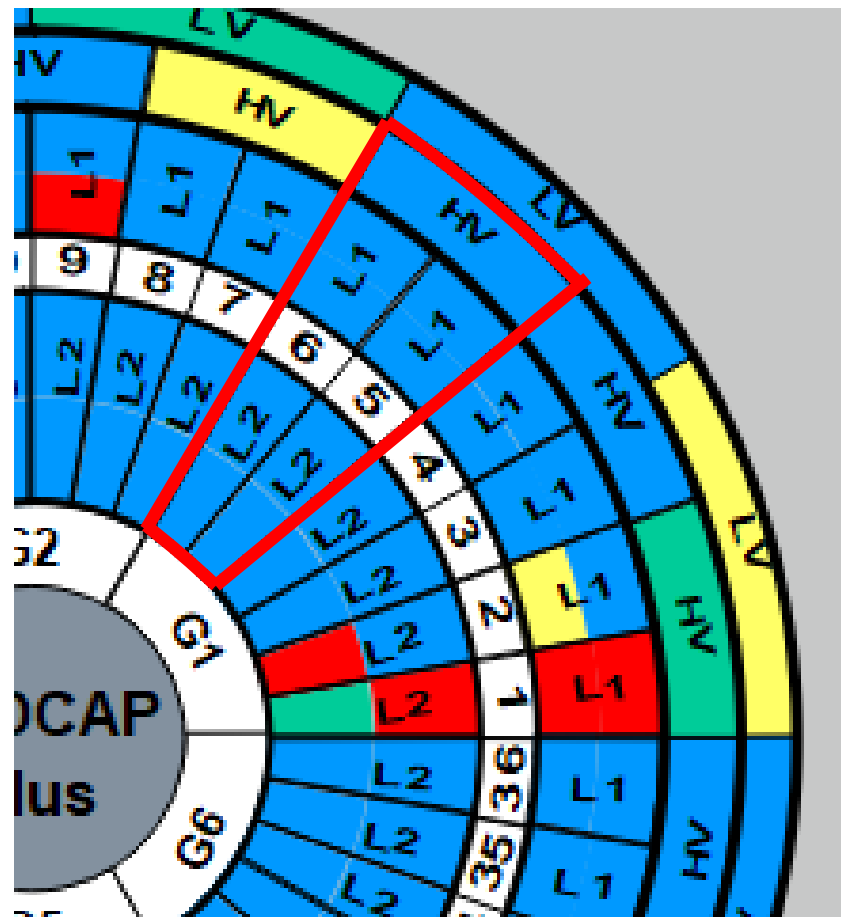
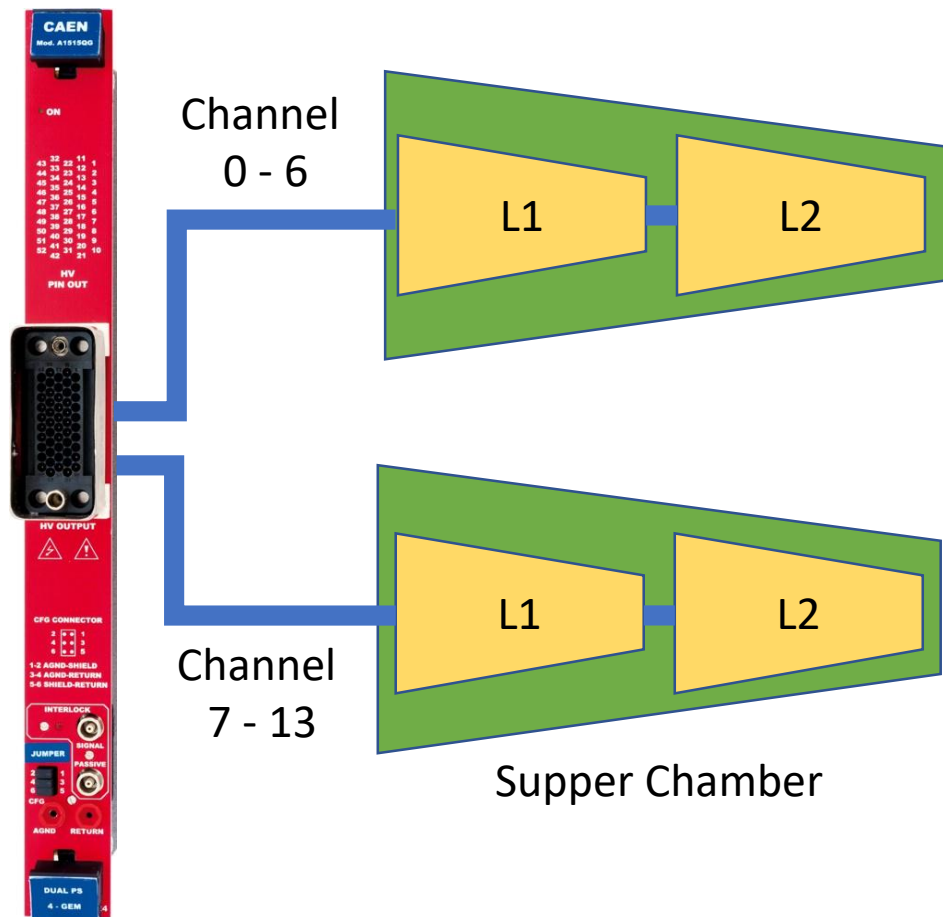
❖ One LV board is connected to 6 Chambers



- L1 – Layer 1 Chamber
- L2 – Layer 2 Chamber
- HV – HV Power Supply Board
- LV – LV Power Supply Board



❖ One HV board is connected to 4 Chambers



❖ HV Board Name

❖ Board On or Off Status

❖ Board Status

❖ Change Settings panel will open

❖ Connected Chambers

❖ Voltage

❖ Current

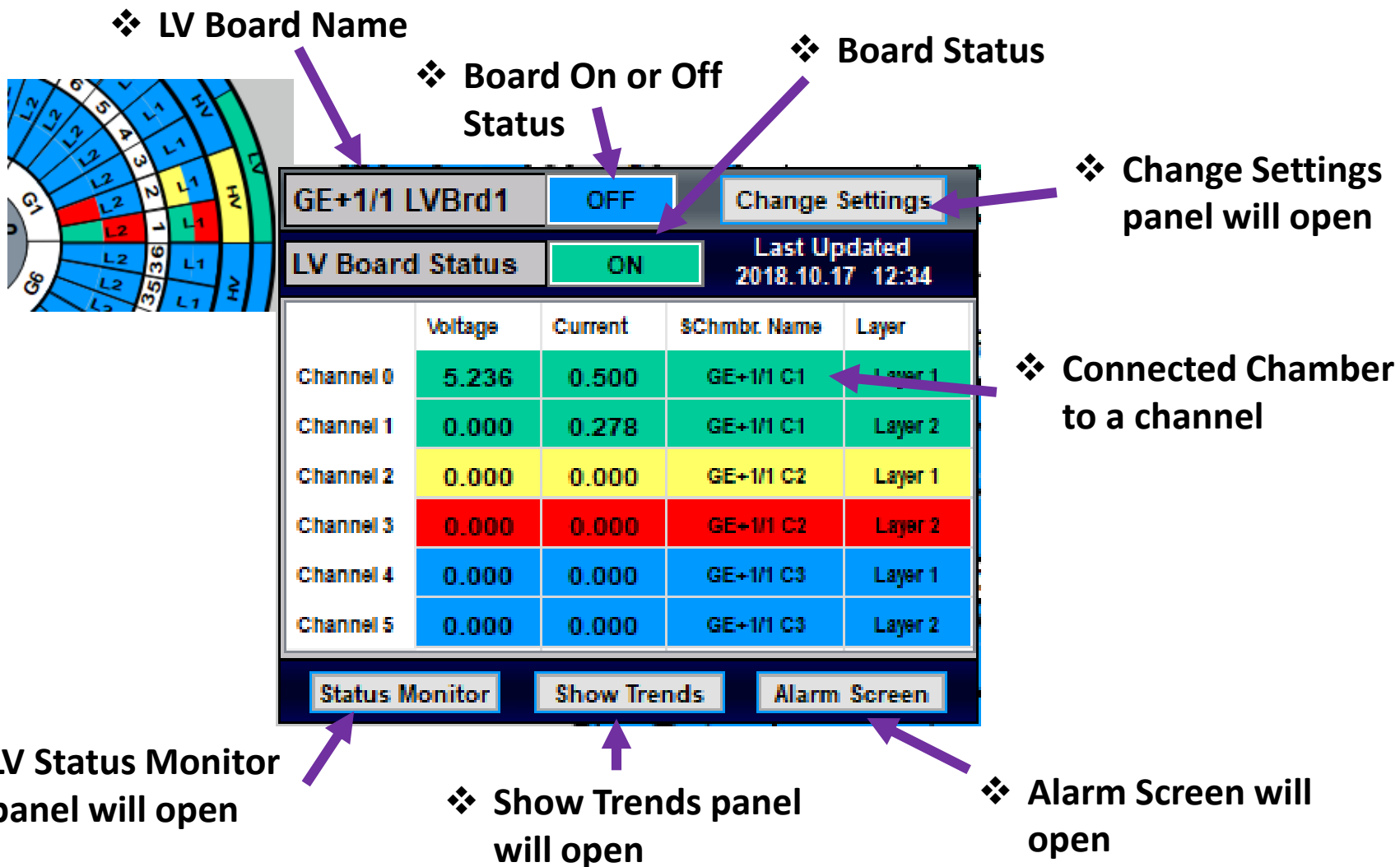
❖ HV Status Monitor panel will open

❖ Show Trends panel will open

❖ Alarm Screen will open

Super Chamber No 1 , Layer1 & Layer2							
	Ch 0	Ch 1	Ch 2	Ch 3	Ch 4	Ch 5	Ch 6
V	200	338	256	412	854	891	2145
C	0.300	0.844	1.244	1.756	2.200	2.656	2.711

Super Chamber No 2 , Layer1 & Layer2							
	Ch 7	Ch 8	Ch 9	Ch 10	Ch 11	Ch 12	Ch 13
V	0	0	0	0	0	0	0
C	0.000	0.000	0.000	0.000	0.000	0.000	0.000



❖ LV Board Name

❖ Board On or Off Status

❖ Board Status

❖ Change Settings panel will open

❖ Connected Chamber to a channel

❖ LV Status Monitor panel will open

❖ Show Trends panel will open

❖ Alarm Screen will open

	Voltage	Current	\$Chmbr. Name	Layer
Channel 0	5.236	0.500	GE+1/I C1	Layer 1
Channel 1	0.000	0.278	GE+1/I C1	Layer 2
Channel 2	0.000	0.000	GE+1/I C2	Layer 1
Channel 3	0.000	0.000	GE+1/I C2	Layer 2
Channel 4	0.000	0.000	GE+1/I C3	Layer 1
Channel 5	0.000	0.000	GE+1/I C3	Layer 2



Backup

❖ User can move to Settings panel

❖ LV Board Status

Monitor (dist_ - gem1; #1)

LV MONITORING

Connected Chambers: **+GEMINI 1 , +GEMINI 2 , +GEMINI 3** Settings Close

BOARD settings

LV Board ID: **GE+1/1 LVBrd1**

BdStatus: **1** on Show Trendpage

Board Dp: **CAEN/GEM_CAEN_LV/branchController00/easyCrate0/easyBoard00**

UNITS

Dimension or parameter	Unit
Voltage	V
Current	uA
Ramp up/down	V/s
Triptime	s

iMonRange = FALSE = High
ZCAadjust = FALSE = Dis
ZCDetect = FALSE = Off
OpMode = FALSE = Free

Show Trendpage

	OvC	OvV	UnV	Trip	Status
Channel 0	○	○	○	○	1 on
Channel 1	○	○	○	○	1 on
Channel 2	○	○	○	○	3
Channel 3	●	○	○	○	9
Channel 4	○	○	○	○	0 standby/off
Channel 5	○	○	○	○	0 standby/off

STATUS

Status	Meaning
0	off
1	on
2	ramping up
4	ramping down
8	overcurrent
16	overvoltage
32	undervoltage
64	external trip
128	max v
256	external dis
512	internal trip
1024	calibration e
2048	unplugged

	Chamber Name	V0	I0	Vcon	Vmon	Imon	OnOff readBack	OnOff Actual	V1	I1	TripTime	vMax SoftValue	
Channel 0	GE+1/1/01/1	0.000	0.000	0.000	5.236	0.500	On	On	0.000	0.000	0	0	Chanr
Channel 1	GE+1/1/01/2	0.000	0.000	0.000	0.000	0.278	Off	Off	0.000	0.000	0	0	Chanr
Channel 2	GE+1/1/02/1	0.000	0.000	0.000	0.000	0.000	Off	Off	0.000	0.000	0	0	Chanr
Channel 3	GE+1/1/02/2	0.000	0.000	0.000	0.000	0.000	Off	Off	0.000	0.000	0	0	Chanr
Channel 4	GE+1/1/03/1	0.000	0.000	0.000	0.000	0.000	Off	Off	0.000	0.000	0	0	Chanr
Channel 5	GE+1/1/03/2	0.000	0.000	0.000	0.000	0.000	Off	Off	0.000	0.000	0	0	Chanr

readback setting actual readback setting

Move Cursor Over "Channel 0", "Channel 1", etc. to See the Corresponding Channel D

ON
OFF/ STANDBY
RAMPING
ERROR
EXCLUD

❖ Connected chambers

❖ LV Channels Status

❖ Move Cursor over "Channel 0", "Channel 1", etc. to see the corresponding DP



Backup

- ❖ Need Expert access to change values
- ❖ Others can only view

❖ LV board DP name

❖ Board ID

❖ User can move to Status monitor panel

Settings (dist_1 - gem1; #1)

CHANGE LV SETTINGS Connected Chambers: **+GEMINI 1 , +GEMINI 2 , +GEMINI 3** **LV Board ID: GE+1/1 LVBrd1** **Status Monitor**

BOARD settings

BdStatus **Board Dp: CAEN/GEM_CAEN_LV/branchController00/easyCrate0/easyBoard00**

Channel settings

	Chamber Name	OnOff	V0	V1	I0	I1	TripTime	SoftValue	vMax	Vmon	Imon	I0 readBack
Channel 0	GE+1/1/01/1	On ▾	0.000	0.000	0.000	0.000	0	0.000		5.236	0.500	0.000
Channel 1	GE+1/1/01/2	Off ▾	0.000	0.000	0.000	0.000	0	0.000		0.000	0.278	0.000
Channel 2	GE+1/1/02/1	Off ▾	0.000	0.000	0.000	0.000	0	0.000		0.000	0.000	0.000
Channel 3	GE+1/1/02/2	Off ▾	0.000	0.000	0.000	0.000	0	0.000		0.000	0.000	0.000
Channel 4	GE+1/1/03/1	Off ▾	0.000	0.000	0.000	0.000	0	0.000		0.000	0.000	0.000
Channel 5	GE+1/1/03/2	Off ▾	0.000	0.000	0.000	0.000	0	0.000		0.000	0.000	0.000

(V) (V) (A) (A) (s) (V) (V) (A) (A)

(V) (A)

Click "Apply" to apply settings

Move Cursor Over "Drift", "G1Top", etc. to See the Corresponding Channel Dp

■ ON ■ OFF/ STANDBY ■ RAMPING ■ ERROR ■ EXCLUDED



Backup