

Hall-B Slow Controls

N. Baltzell

2nd 1st CLAS12 Experiment Workshop

February 23, 2016

Overview

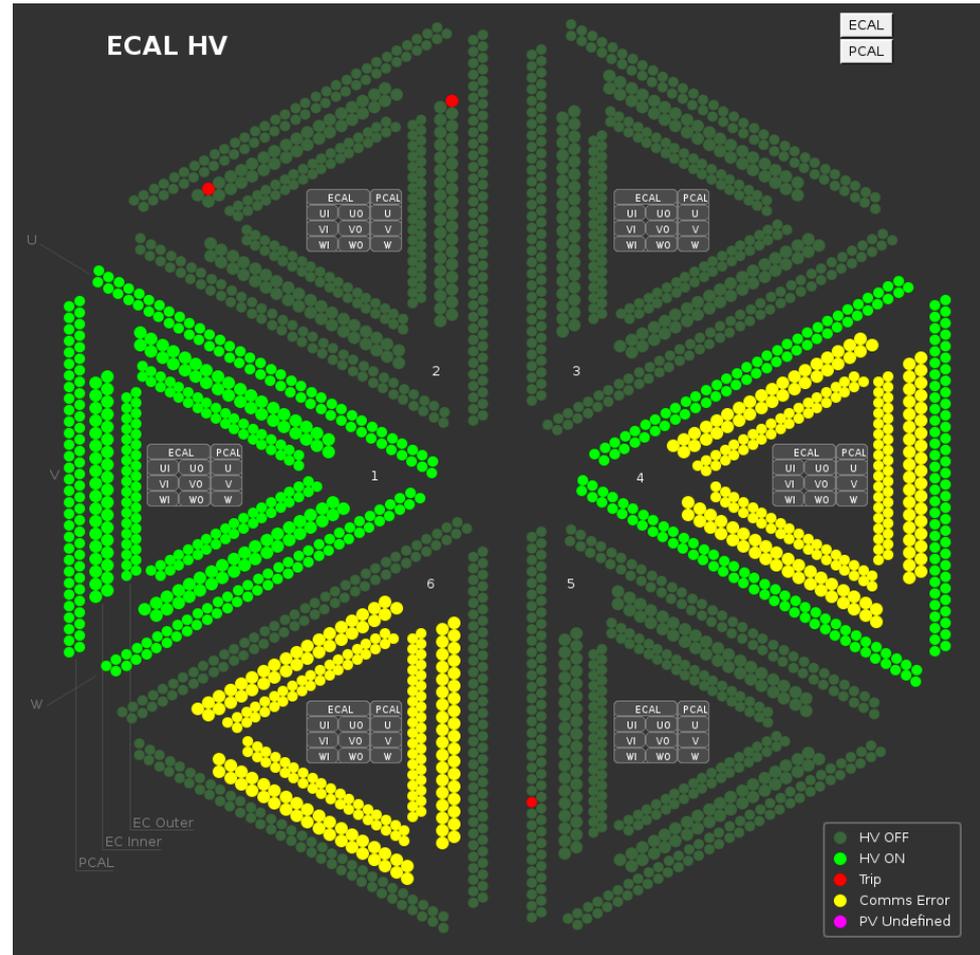
- Hall-B Team:
 - Glasgow & JLab: N. Baltzell, K. Livingston, B. McKinnon, W. Moore
 - Biweekly meetings: 8:30 on Fridays in L210A
 - Wiki: https://clasweb.jlab.org/wiki/index.php/CLAS12_Slow_Controls
 - With meeting agendas and minutes, Gantt chart, subsystem specs, improving documentation
 - First goal: KPP, full baseline support by summer's end
 - Essential Groups Involved:
 - *Detector Support Group (Torus/Solenoid/Cryo/Gas)*
 - *S. Boyarinov (DAQ)*
- Framework:
 - UI: java-based CS-Studio
 - OS: RHEL7
 - EPICS: R3.14.12.5
 - Lots of sharing with Hall-D
 - BEAST alarm handler inside CS-Studio
 - JLab Mya EPICS archiver
 - Porting & improving/replacing CLAS6 software
 - Upgrading hardware where necessary/possible

Overview

- Detector specific GUIs developed and in use
- Hierarchical system with navigable tree view
- Alarm system tested and to be deployed spring 2016
- Gas/Torus/Solenoid/Cryo EPICS interface in progress
- DAQ-Integration developed with HPS
- Moller counters refurbished
- Hardware Purchases Ongoing
- FTC controls

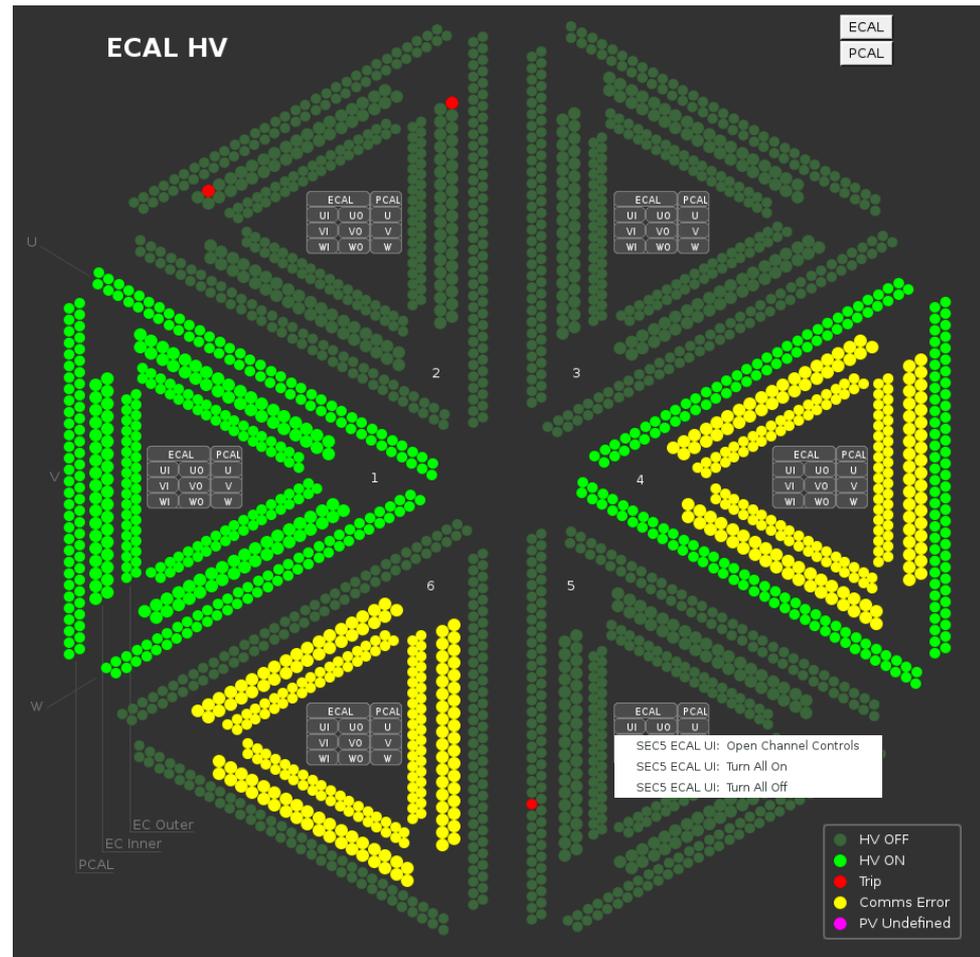
Detector HV

- Geographic screens for HV
 - shows status via color
 - trip/on/off/ramping/comms



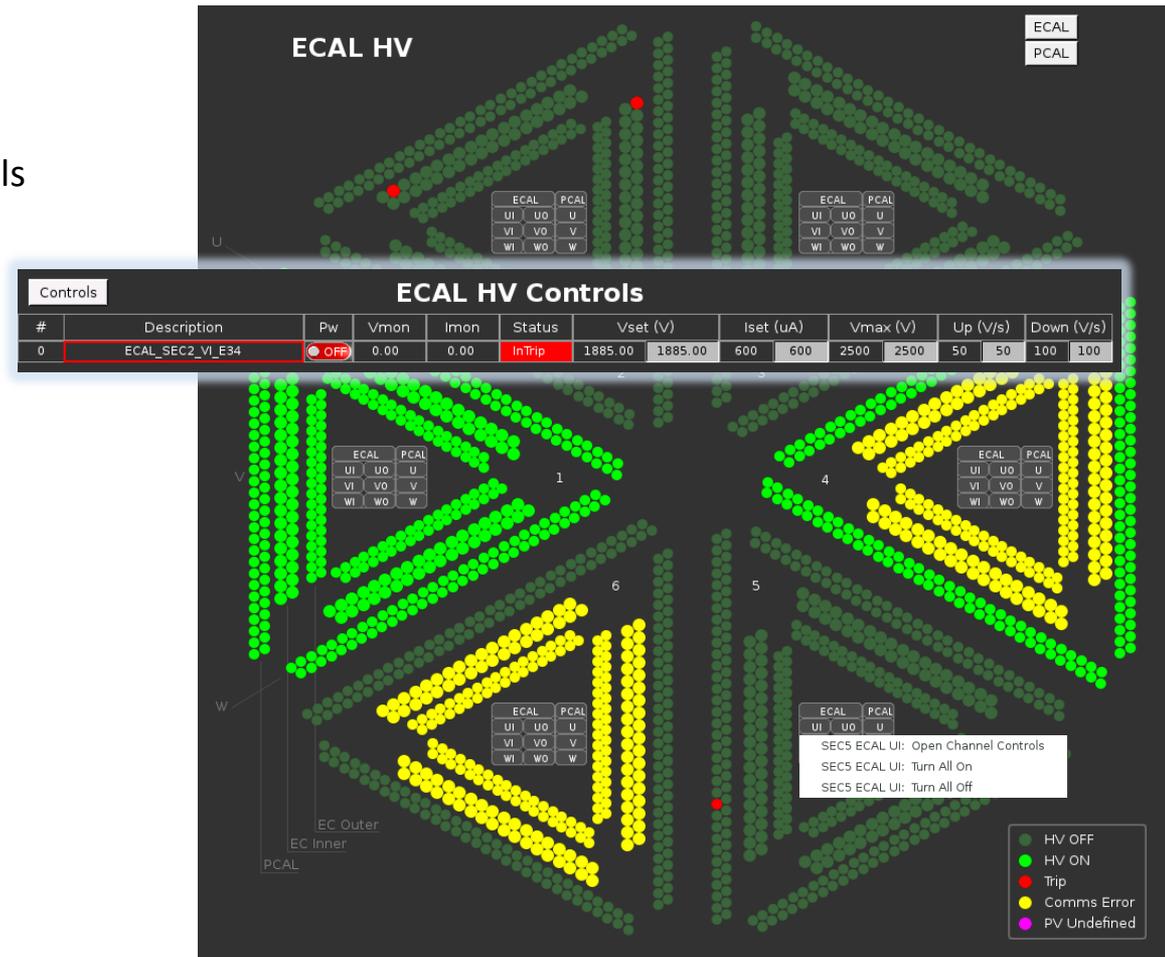
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- Provides access to
 - global/group/individual controls
 - save/restore

The interface displays a geographic map of the ECAL detector channels. The channels are represented by colored dots: green for HV OFF, yellow for HV ON, red for Trip, magenta for Comms Error, and pink for PV Undefined. The map is divided into sections labeled 1, 4, 5, and 6. A legend in the bottom right corner defines the colors: HV OFF (green), HV ON (yellow), Trip (red), Comms Error (magenta), and PV Undefined (pink).

The **ECAL HV Controls** table provides detailed parameters for each channel:

#	Description	Pw	Vmon	Imon	Status	Vset (V)	Iset (uA)	Vmax (V)	Up (V/s)	Down (V/s)
0	ECAL_SEC2_VI_E34	OFF	0.00	0.00	InTrip	1885.00	1885.00	600	50	100

Additional controls and settings are visible in the interface, including 'Save Settings', 'Restore Settings', and a 'Controls' panel with buttons for 'Open Channel Controls', 'Turn All On', and 'Turn All Off'.

Detector HV

- Geographic screens for HV
 - shows status via color
 - trip/on/off/ramping/comms
- Provides access to
 - global/group/individual controls
 - save/restore
- ECAL,PCAL,FTOF,CTOF,HTCC
 - Coming soon: DC, LTCC

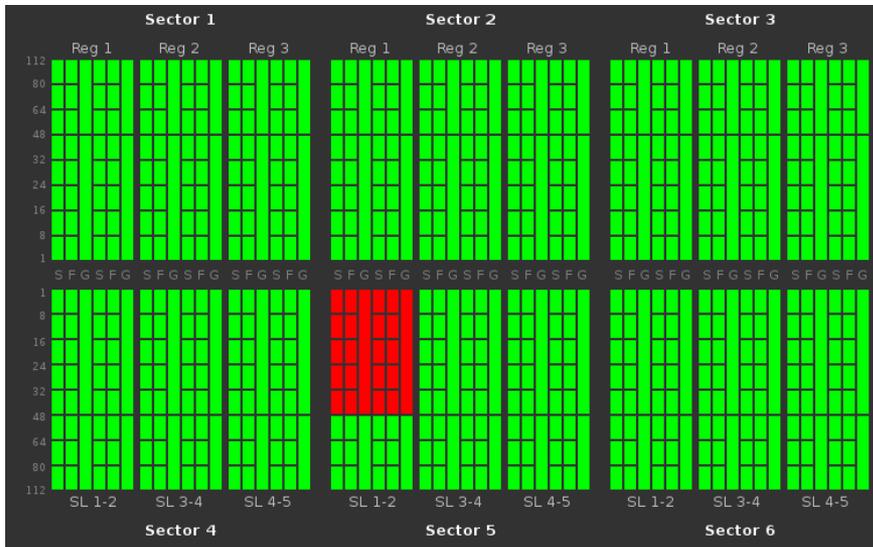
The interface displays a large detector map with HV status indicators. A control panel is overlaid on the map, showing a table of HV channels and their parameters.

Controls		ECAL HV Controls													
#	Description	Pw	Vmon	lmon	Status	Vset (V)		Iset (uA)		Vmax (V)		Up (V/s)		Down (V/s)	
0	ECAL_SEC2_VI_E34	OFF	0.00	0.00	InTrip	1885.00	1885.00	600	600	2500	2500	50	50	100	100

Buttons: Save Settings, Restore Settings

Legend:

- HV OFF
- HV ON
- Trip
- Comms Error
- PV Undefined



Alarm Handler

CS-Studio

File Edit Search CS-Studio Window Help

Alarm Area Panel ECAL HV Control

DC

ECAL

FTOF

LTCC

PCAL

ECAL HV Controls

#	Description	Pw	Vmon	Imon	Status	Vset (V)	Iset (uA)	Vmax (V)	Up (V/s)	Down (V/s)
0	ECAL_SEC2_VI_E34	OFF	0.00	0.00	InTrip	1885.00	600	2500	50	100

Alarm Tree

HallB

- Area: High Voltage (UNDEFINED/No Connection)
 - System: DC (UNDEFINED/No Connection)
 - System: ECAL (MAJOR/HIGH_ALARM)
 - System: SEC1
 - System: SEC2 (MAJOR/HIGH_ALARM)
 - System: UI (MAJOR/HIGH_ALARM)
 - System: UO
 - System: VI (MAJOR/HIGH_ALARM)
 - System: VO
 - System: WI
 - System: WO
 - System: SEC3
 - System: SEC4
 - System: SEC5
 - System: SEC6
 - System: FTOF
 - System: LTCC
 - System: PCAL (MAJOR/HIGH_ALARM)
 - System: SEC1

Hierarchical Tree View

- Navigate through entire system
 - by detector/sector
 - *with wildcard search*
- Graphs can be included in any screen
 - e.g. HV Current/Voltage
- Hierarchy to be used for alarm system
 - including daq info, scalers, etc

CLAS12 EPICS Tree - Select with

B
B_SYS
B_SYS_HV
B_SYS_HV_ECAL
B_SYS_HV_ECAL_SEC1

Or do wildcard search
B_SYS_HV_ECAL_SEC1_UI*
B_SYS_HV_ECAL_SEC1_UI

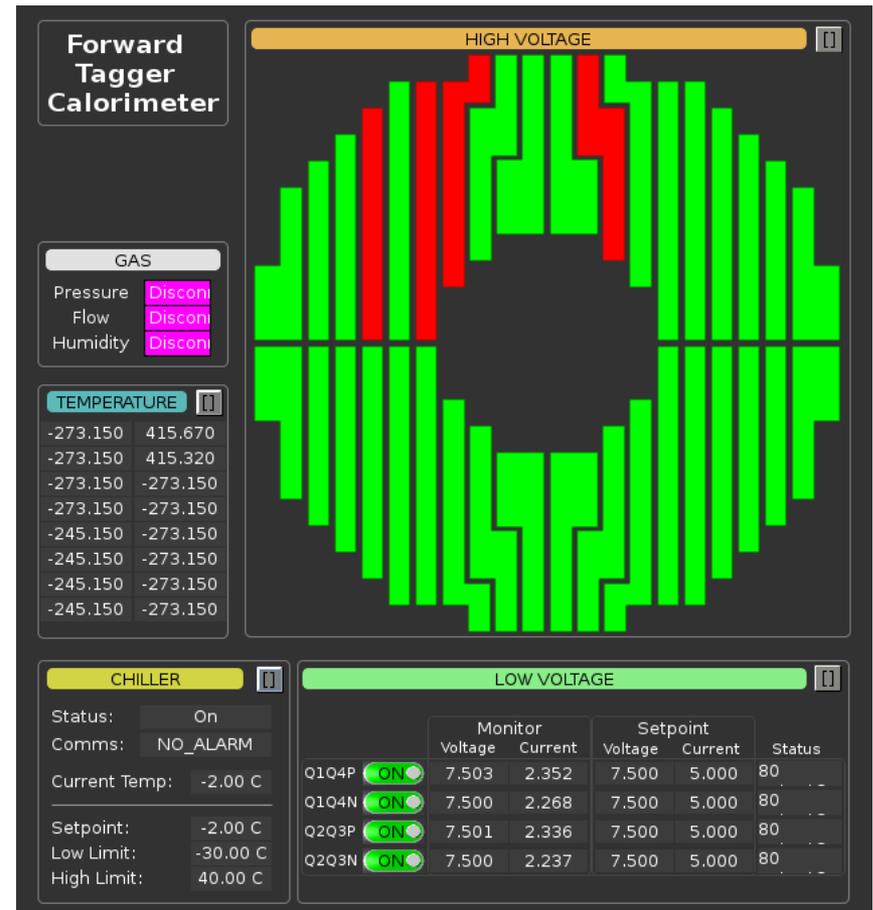
B_SYS_HV_ECAL_SEC1_UI pwnoff->ON pwnoff->OFF

VGraph | Graph | Image

#	Element	Pw	Vmon	Imon	Status	Vset (V)	Iset (uA)	Change view ...
0	E01	ON	1001.50	192.50	ON	1001.00	500.00	Disconnected
1	E02	ON	1766.50	407.00	ON	1767.00	500.00	Disconnected
2	E03	ON	1827.00	422.50	ON	1827.00	500.00	Disconnected
3	E04	ON	1781.00	412.50	ON	1781.00	500.00	Disconnected
4	E05	ON	1808.00	422.50	ON	1808.00	500.00	Disconnected
5	E06	ON	1629.00	372.00	ON	1629.00	500.00	Disconnected
6	E07	ON	1944.00	455.50	ON	1944.00	500.00	Disconnected
7	E08	ON	2015.00	478.00	ON	2015.00	500.00	Disconnected
8	E09	ON	1938.50	458.50	ON	1939.00	500.00	Disconnected
9	E10	ON	1877.00	444.00	ON	1877.00	500.00	Disconnected
10	E11	ON	1968.00	460.00	ON	1968.00	500.00	Disconnected
11	E12	ON	1909.50	444.50	ON	1909.00	500.00	Disconnected
12	E13	ON	1940.50	454.50	ON	1940.00	500.00	Disconnected
13	E14	ON	1956.50	476.00	ON	1956.00	500.00	Disconnected
14	E15	ON	1915.00	457.00	ON	1915.00	500.00	Disconnected
15	E16	ON	1840.50	425.00	ON	1840.00	500.00	Disconnected
16	E17	ON	1928.50	451.50	ON	1928.00	500.00	Disconnected
17	E18	ON	1907.00	465.50	ON	1907.00	500.00	Disconnected
18	E19	ON	2007.00	476.00	ON	2007.00	500.00	Disconnected

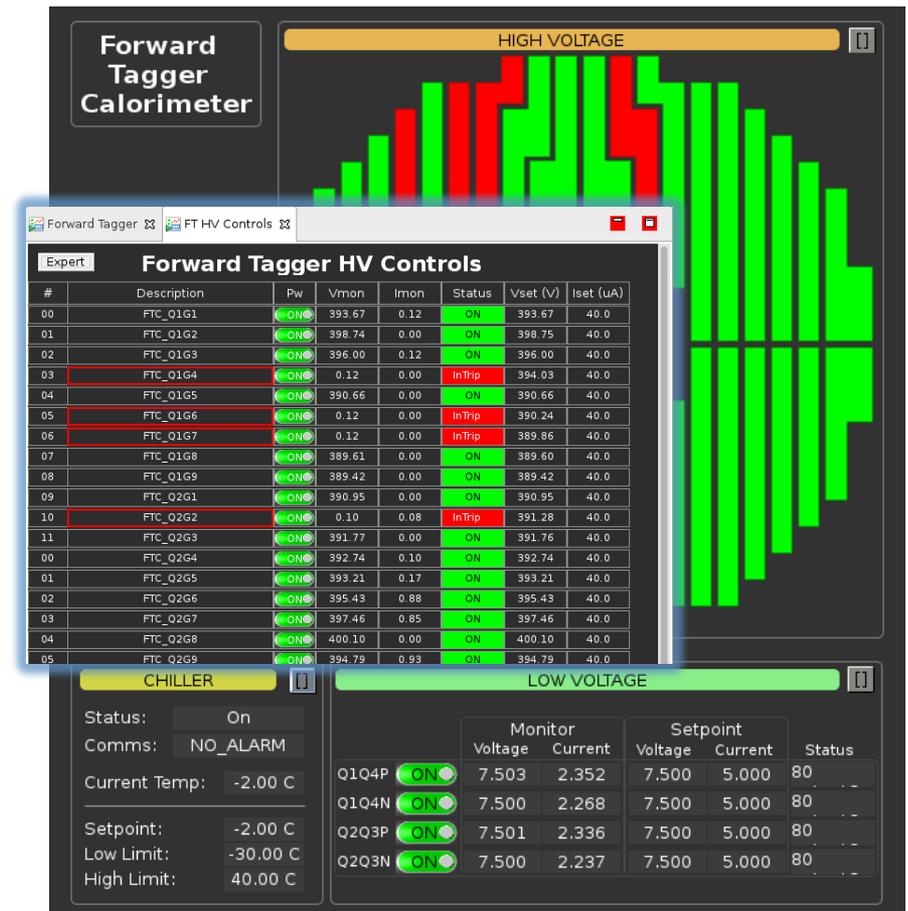
Detector Overview Screens

- By request of detector groups
- Example shown for FTC
 - Includes HV, LV, Gas, Temps, Chiller
 - Links to controls for each subsystem
 - Involvement from detector group
- Similar overview for HTCC exists



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 - Links to controls for each subsystem
 - Involvement from detector group
- Similar overview for HTCC exists
- Flasher controls screen

Forward Tagger Expert GUI

Driver Control

ON OFF

Reset Controller

Board: Channel
x coord y coord
scaler rate

1	2
3	4
5	6

Sequence settings

pts/ftcFlasherDefaultSeq.sh

Upload new sequence

START STOP

Selected Driver Channel

81 80 83 Turn on

prev. x=-5 next y=-4

Amplitude 1550 2,300 Apply to all

Width 3000 3,000 Apply to all

e/classrun/Desktop/temp/ Load data

sherDefaultChannels.dat Save data

Scan settings

Time On (s): 0

Time Off (s): 0

Set LED: [Color]

START STOP

Controller settings

Clock Mode: INT

Overwrite: ON

Freq (Hz): 62

Raw commands (expert)

Command: (40 char) max

Response: (40 char) max

ON

Network

IP Addr: 129.57.86.112

Netmask: 255.255.255.0

Gateway: 129.57.86.1

ftp serv: 192.168.1.1

Channel Selection Grid

selected on

Amplitude vs Channel Graph

Y-axis: Amplitude (0 to 4095)

X-axis: Channel (0 to 223)

Channel Status Table

#	Channel	Status	Value 1	Value 2	Value 3	Value 4
00						
01						
02						
03						
04						
05						
06						
07						
08	FTC_Q1G9	ON	389.42	0.00	389.42	40.0
09	FTC_Q2G1	ON	390.95	0.00	390.95	40.0
10	FTC_Q2G2	InTrip	0.10	0.08	391.28	40.0
11	FTC_Q2G3	ON	391.77	0.00	391.76	40.0
00	FTC_Q2G4	ON	392.74	0.10	392.74	40.0
01	FTC_Q2G5	ON	393.21	0.17	393.21	40.0
02	FTC_Q2G6	ON	395.43	0.88	395.43	40.0
03	FTC_Q2G7	ON	397.46	0.85	397.46	40.0
04	FTC_Q2G8	ON	400.10	0.00	400.10	40.0
05	FTC_Q2G9	ON	394.79	0.93	394.79	40.0

CHILLER

Status: On

Comms: NO_ALARM

Current Temp: -2.00 C

Setpoint: -2.00 C

Low Limit: -30.00 C

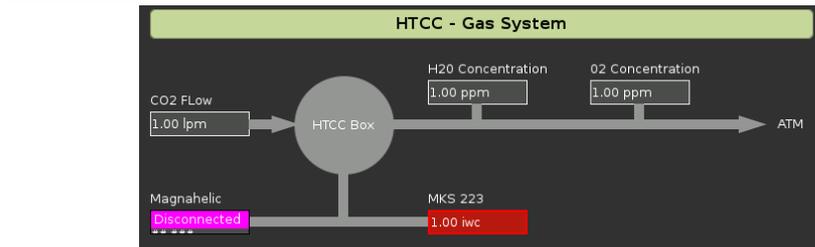
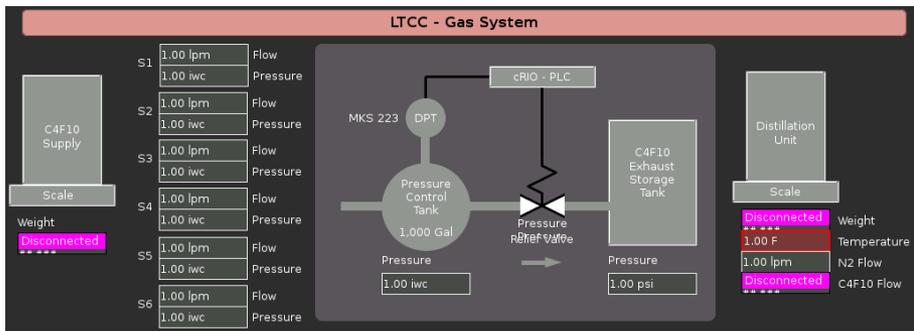
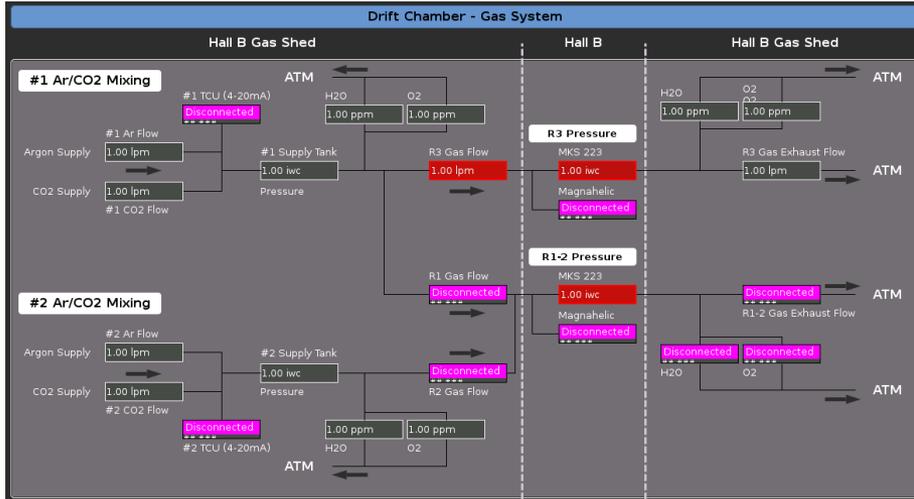
High Limit: 40.00 C

LOW VOLTAGE

	Status	Monitor		Setpoint		Status
		Voltage	Current	Voltage	Current	
Q1Q4P	ON	7.503	2.352	7.500	5.000	80
Q1Q4N	ON	7.500	2.268	7.500	5.000	80
Q2Q3P	ON	7.501	2.336	7.500	5.000	80
Q2Q3N	ON	7.500	2.237	7.500	5.000	80

Gas System

- CompactRIO (DSG)
- EPICS integration for user monitoring & alarms in counting house in progress



Hall B Gas System EPICS Process Variables										
Detector/System	Signal Name	Location	Units	Nominal Value	EPICSA Alarm	Alarms		Data Type	EPICS PV	PV #
						HI	LO			
Drift Chambers	DC 1 Mix Ar Flow	Gas Shed	slm	5-250				SGL	B_DET_DC_1_ArFlow	1
	DC 1 Mix Ar Flow_Setpoint	Gas Shed	slm	5-250				SGL	B_DET_DC_1_ArFlowSet	2
	DC 1 Mix CO2 Flow	Gas Shed	slm	0.55-27.5				SGL	B_DET_DC_1_CO2Flow	3
	DC 1 Mix CO2 Flow_Setpoint	Gas Shed	slm	0.55-27.5				SGL	B_DET_DC_1_CO2FlowSet	4
	DC 2 Mix Ar Flow	Gas Shed	slm	5-250				SGL	B_DET_DC_2_ArFlow	5
	DC 2 Mix Ar Flow_Setpoint	Gas Shed	slm	5-250				SGL	B_DET_DC_2_ArFlowSet	6
	DC 2 Mix CO2 Flow	Gas Shed	slm	0.55-27.5				SGL	B_DET_DC_2_CO2Flow	7
	DC 2 Mix CO2 Flow_Setpoint	Gas Shed	slm	0.55-27.5				SGL	B_DET_DC_2_CO2FlowSet	8
	DC R1 Gas Supply Flow	Gas Shed	slm	12-80	X	90	12	SGL	B_DET_DC_R1_SupFlow	9
	DC R1 Gas Supply Flow_Setpoint	Gas Shed	slm	12-80				SGL	B_DET_DC_R1_SupFlowSet	10
	DC R2 Gas Supply Flow	Gas Shed	slm	36-200	X	220	36	SGL	B_DET_DC_R2_SupFlow	11
	DC R2 Gas Supply Flow_Setpoint	Gas Shed	slm	36-200				SGL	B_DET_DC_R2_SupFlowSet	12
	DC R3 Gas Supply Flow	Gas Shed	slm	24-160	X	170	24	SGL	B_DET_DC_R3_SupFlow	13
	DC R3 Gas Supply Flow_Setpoint	Gas Shed	slm	24-160				SGL	B_DET_DC_R3_SupFlowSet	14
	DC Mix H2O	Gas Shed	ppm	10	X	50		SGL	B_DET_DC_R1_SupH2O	15
	DC R1-R2_Return_H2O	Gas Shed	ppm	50	X	100		SGL	B_DET_DC_R2_SupH2O	16
	DC R3_Return_H2O	Gas Shed	ppm	50	X	100		SGL	B_DET_DC_R3_SupH2O	17
	DC Mix O2	Gas Shed	ppm	10	X	25		SGL	B_DET_DC_R1_SupO2	18
	DC R1-R2_Return_O2	Gas Shed	ppm		X	25		SGL	B_DET_DC_R2_SupO2	19
	DC R3_Return_O2	Gas Shed	ppm		X	25		SGL	B_DET_DC_R3_SupO2	20
	DC 1 Pressure	Space Frame	"wc		X			SGL	B_DET_DC_1_Press	21
	DC 2 Pressure	Space Frame	"wc		X			SGL	B_DET_DC_2_Press	22
	DC R1-2_Control_Press	Space Frame	"wc	0.05	X	0.1	0.025	SGL	B_DET_DC_R12_CtrlPress	23
	DC R3_Control_Press	Space Frame	"wc	0.05	X	0.1	0.025	SGL	B_DET_DC_R3_CtrlPress	24
	DC R1-2_GAS_Return_Flow	Gas Shed	slp					SGL	B_DET_DC_R12_ReturnFlow	25
	DC R3_GAS_Return_Flow	Gas Shed	slp					SGL	B_DET_DC_R3_ReturnFlow	26
	DC 1_Gas_TC					X		SGL	B_DET_DC_1_TC	27
	DC 2_Gas_TC					X		SGL	B_DET_DC_2_TC	28
	DC R1-2_Press		"wc	0.05	X	0.1	0.025	SGL	B_DET_DC_R12_Press	29
	DC R3_Press		"wc	0.05	X	0.1	0.025	SGL	B_DET_DC_R3_Press	30
LTCC S1_Flow	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_S1_Flow	31	
LTCC S1_Flow_Setpoint	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_S1_FlowSet	32	
LTCC S2_Flow	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_S2_Flow	33	
LTCC S2_Flow_Setpoint	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_S2_FlowSet	34	
LTCC S3_Flow	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_S3_Flow	35	
LTCC S3_Flow_Setpoint	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_S3_FlowSet	36	
LTCC S4_Flow	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_S4_Flow	37	
LTCC S4_Flow_Setpoint	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_S4_FlowSet	38	
LTCC S5_Flow	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_S5_Flow	39	
LTCC S5_Flow_Setpoint	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_S5_FlowSet	40	
LTCC S6_Flow	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_S6_Flow	41	
LTCC S6_Flow_Setpoint	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_S6_FlowSet	42	
LTCC_Dist_SupFlow	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_Dist_SupFlow	43	
LTCC_Dist_SupFlow_Setpoint	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_Dist_SupFlowSet	44	
LTCC_Dist_N2_Flow	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_Dist_N2Flow	45	
LTCC_Dist_N2_Flow_Setpoint	Forward Carriage	slm	0-5				SGL	B_DET_LTCC_Dist_N2FlowSet	46	
LTCC_Control_Tank_Press	Forward Carriage	"wc	0.1-2	X	2	0.025	SGL	B_DET_LTCC_CtrlTank_Press	47	
LTCC S1_Press	Forward Carriage	"wc	0.1-2	X	2	0.025	SGL	B_DET_LTCC_S1_Press	48	
LTCC S2_Press	Forward Carriage	"wc	0.1-2	X	2	0.025	SGL	B_DET_LTCC_S2_Press	49	
LTCC S3_Press	Forward Carriage	"wc	0.1-2	X	2	0.025	SGL	B_DET_LTCC_S3_Press	50	
LTCC S4_Press	Forward Carriage	"wc	0.1-2	X	2	0.025	SGL	B_DET_LTCC_S4_Press	51	
LTCC S5_Press	Forward Carriage	"wc	0.1-2	X	2	0.025	SGL	B_DET_LTCC_S5_Press	52	
LTCC S6_Press	Forward Carriage	"wc	0.1-2	X	2	0.025	SGL	B_DET_LTCC_S6_Press	53	
LTCC_Dist_Temp	Forward Carriage	deg F	-40 to -10	X	-10	-40	SGL	B_DET_LTCC_Dist_Temp	54	
LTCC_Return_Tank_Press	Forward Carriage	psig	<25	X	20		SGL	B_DET_LTCC_ReturnTank_Press	55	
HTCC CO2_Supply_Flow	Space Frame	slm	1-50	X			SGL	B_DET_HTCC_CO2SupFlow	56	
HTCC CO2_Supply_Flow_Setpoint	Space Frame	slm			N/A		SGL	B_DET_HTCC_CO2SupFlowSet	57	
HTCC ppm_H2O	Space Frame	ppm	50	X	50		SGL	B_DET_HTCC_H2O	58	
HTCC ppm_O2	Space Frame	ppm	200	X	200		SGL	B_DET_HTCC_O2	59	
HTCC_Press	Space Frame	"wc	>0.025-0.1	X	0.1		SGL	B_DET_HTCC_Press	60	
SVT N2_Supply_Flow	Space Frame	slm	>1<50	X		<1	SGL	B_DET_SVT_N2SupFlow	61	
SVT N2_Supply_Flow_Setpoint	Space Frame	slm			N/A		SGL	B_DET_SVT_N2SupFlowSet	62	
RICH 1_N2_Flow	Space Frame	slm	>1<5	X	5	1	SGL	B_DET_RICH_1_N2Flow	63	
RICH 2_N2_Flow	Space Frame	slm	>1<5	X	5	1	SGL	B_DET_RICH_2_N2Flow	64	
FTC N2_Flow	Space Frame	slm		X			SGL	B_DET_FTC_N2Flow	65	
FTC_Pressure	Space Frame	"wc		X			SGL	B_DET_FTC_Press	66	
FTC_Humidity	Space Frame	%RH		X			SGL	B_DET_FTC_Humidity	67	

Torus, Solenoid

- 3 Allen-Bradley PLCs (DSG): Power Supplies, Vacuum, Cryo
- EPICS integration for user monitoring & alarms in counting house in progress

Torus MPS Auto Control

COMM ●

MPS State

Final Goal Cancel

MAX current A

Setpoint A A/s To Manual

Turn ON MPS

Status Bits

MPS ON <input checked="" type="checkbox"/>	0	Reg Module <input checked="" type="checkbox"/>	12
Polarity <input checked="" type="checkbox"/>		Preregulator <input checked="" type="checkbox"/>	
Reg Transf <input checked="" type="checkbox"/>		Phase <input checked="" type="checkbox"/>	
DAC16 <input checked="" type="checkbox"/>		MPS Waterflow <input checked="" type="checkbox"/>	
DAC17 <input checked="" type="checkbox"/>	5	Leakage <input checked="" type="checkbox"/>	
Unit in % <input checked="" type="checkbox"/>	6	Fuses <input checked="" type="checkbox"/>	17
Fast Dump <input checked="" type="checkbox"/>		Over Temp <input checked="" type="checkbox"/>	18
Transistor <input checked="" type="checkbox"/>		Door <input checked="" type="checkbox"/>	
SUM Interlock <input checked="" type="checkbox"/>		Magnet Water <input checked="" type="checkbox"/>	
Over Current <input checked="" type="checkbox"/>		Slow Dump <input checked="" type="checkbox"/>	
DC Overload <input checked="" type="checkbox"/>	11	MPS Ready <input checked="" type="checkbox"/>	
		n/c <input checked="" type="checkbox"/>	23

Current A

Voltage V

Field T

Thresholds

Quench Line A

50 A Dump Threshold A

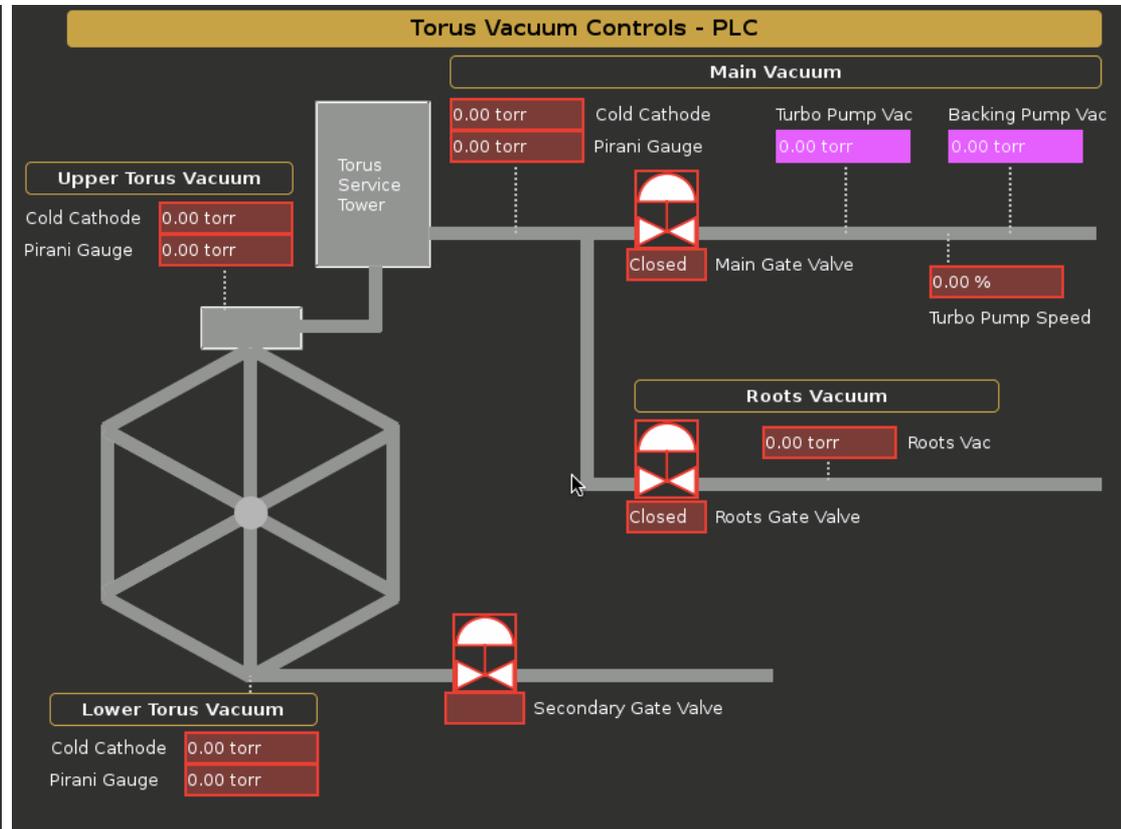
25 A Warning Threshold A

Normal Current A

Set LOCAL Reset MPS COMM Slow DUMP

Reset MPS Reset Dump Diode Fast DUMP

Dump Diode Reset Time ms



Summary / Outlook

Progress Status

- HV System [95%]
- Alarms [50%]
- Beamline Motors/Scalers [80%]
- Moller Polarimeter [10%]
- EPICS ↔ DAQ [90%]
- EPICS ⇒ rundb [95%]
- MYA Archiver [50%]
- Select FADC/DISC Scalers [0%]
- Gas System [75%]
- Torus, Solenoid, Cryo [75%]
- Saclay Target [EPICS=0%]
- Hall Weather [50%]
- Wiener Crates [80%]
- IOC Admin [90%]
- Detector Specific Screens [50%]
- SVT (by OPS) [95%]
- BTA [0%]

- En Route to KPP by end of summer 2016
- Some of the bigger unfinished pieces:
 - Refurbish Moller Polarimeter system
 - FADC/DISC2 scalers to EPICS
 - Saclay Target integration into EPICS

Wish List

- Web browser access (WebOPI/VDI)
- All FADC/DISC Scalers in EPICS
- Full DAQ controls in CS-Studio
- Full SVT integration in CS-Studio
- More ...

Upgrade Purchases

- Server for Mya EPICS archiver (all systems)
- MOXA serial comms (various → EPICS)
 - chillers, thermocouples, gaussmeters ...
- GPIB-ETH converters (DC LV → EPICS)
- Weather system (FC, SF, CH) *
 - Temperature+Humidity
- CAEN mainframe CPU+MPS (HV)
- Cameras (general) *
- Additional server for remote users *



* not finalized