



clas Slow Controls

N. Baltzell

4th 1st CLAS12 Experiment Workshop

November 1, 2016

Overview

Organization

- Main Team: N. Baltzell, K. Livingston, B. McKinnon, W. Moore
- Biweekly Meetings: 9:00 on Fridays in L210A
- Wiki: https://clasweb.jlab.org/wiki/index.php/CLAS12_Slow_Controls
 - With meeting agendas and minutes, planning docs, subsystem specs, improving documentation
- Working with DAQ, DSG, Engineering, I&C, IT groups

Framework

- “Everything” in EPICS (R3.14.12.15)
- CS-Studio for uniform user interface (java-based)
- BEAST alarm system (databases+servers+clients)
- JLab ops’s MYA archiving system

Components

- Software and Servers
- Detectors
 - HV, LV, Gas, Temperature, Chillers, Flashers, PLCs, FEBs
 - JLab FADC/DISC Scalers
- SC Magnets
 - PLCs, Power Supplies, Vacuum, Cryo
- Beamline
 - Motors, Harps, Møller Polarimeter*
- Targets
 - Saclay Cryotarget*
- Hall
 - Weather, Cameras
- DAQ
 - Crate monitoring/reset
 - Trigger rates, config, livetime, BTA

Software / Computing

All CLAS12 online software is version controlled in JLab's github @ clas12-epics, clas12-plc, clas12-coda, ...

- Shift operations always use our github hotfix build at:
/usr/c las12/release/pro

Controls servers/workstations

- All 64-bit RHEL7
- OS installs and configs deployed and managed with Puppet and monitored by Nagios with regular automatic checks on
 - cpu/disk/memory usage
 - necessary software running (e.g. alarm server)
 - with email notifications
- Current lineup:
 - clonpc11-22 shifters' workstations
 - clonsl1-3 servers for non-counting-house use
 - clonioc1-4, clondb3 for servers, softIOCs, gateways

EPICS

- Soft IOCs started/checked automatically, procServ-managed
 - minimize hard-IOCs (beamline scalers, motors, old magnets)
 - autosave, full ioc logging, burt save/restore
- BEAST alarm system with notifications, alarm history logging

IOC Name	Hostname	Up Time	Heartbeat	Expert	Soft Reboot	Last Reboot	Console	Hard Reboot
ioccaenhv_HVECAL1	clonioc2.jlab.org	19 days, 05:06:48	1660008		Reboot	10/12/2016 10:59:13		Reboot
ioccaenhv_HVECAL2	clonioc2.jlab.org	04:42:36	16956		Reboot	10/31/2016 11:23:25		Reboot
ioccaenhv_HVECAL3	clonioc2.jlab.org	34 days, 23:45:05	3023105		Reboot	09/26/2016 16:20:55		Reboot
ioccaenhv_HVECAL4	clonioc2.jlab.org	34 days, 23:45:06	3023106		Reboot	09/26/2016 16:20:55		Reboot
ioccaenhv_HVECAL5	clonioc2.jlab.org	34 days, 23:45:06	3023106		Reboot	09/26/2016 16:20:55		Reboot
ioccaenhv_HVECAL6	clonioc2.jlab.org	20 days, 01:41:18	1734078		Reboot	10/11/2016 14:24:43		Reboot
ioccaenhv_HVFTOF1	clonioc2.jlab.org	25 days, 05:25:12	2179512		Reboot	10/06/2016 10:40:49		Reboot
ioccaenhv_HVFTOF2	clonioc2.jlab.org	34 days, 23:45:02	3023102		Reboot	09/26/2016 16:20:58		Reboot
ioccaenhv_HVFTOF3	clonioc2.jlab.org	34 days, 23:45:02	3023102		Reboot	09/26/2016 16:20:59		Reboot
ioccaenhv_HVFTOF4	clonioc2.jlab.org	34 days, 23:45:02	3023102		Reboot	09/26/2016 16:20:59		Reboot
ioccaenhv_HVFTOF5	clonioc2.jlab.org	34 days, 23:45:03	3023103		Reboot	09/26/2016 16:20:58		Reboot
ioccaenhv_HVFTOF6	clonioc2.jlab.org	34 days, 23:45:03	3023103		Reboot	09/26/2016 16:20:58		Reboot
ioccaenhv_HVFTAG	clonioc2.jlab.org	7 days, 01:15:06	609305		Reboot	10/24/2016 14:50:56		Reboot
ioccaenhv_HVCTOF0	clonioc2.jlab.org	15 days, 20:31:08	1369867		Reboot	10/15/2016 19:34:53		Reboot
ioccaenhv_HVLTCC0	clonioc2.jlab.org	34 days, 23:44:59	3023099		Reboot	09/26/2016 16:21:01		Reboot

JeffersonLab / clas12-epics

Unwatch 7 Star 2 Fork 4

Code Issues Pull requests Projects Wiki Pulse Graphs

Branch: hotfix-v1.3.3 clas12-epics / apps / Create new file Upload files Find file History

This branch is 577 commits ahead of master. Pull request Compare

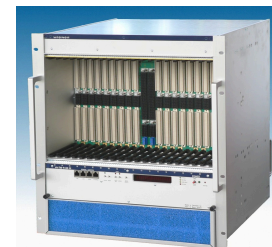
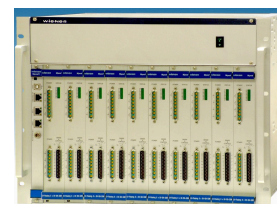
wmoore28 picApp: added torus_bo_renamed.db Latest commit 193f6de 14 minutes ago

- A6551App A6551*.opi: add hook to popup alarm settings, make fields bla... 17 days ago
- DVME628App DVME628App: fixed Implicit declarations a year ago
- SCE410App SCE410App/opi/asyncRecord.opi: dunno why we even have this 3 months ago
- XY240App added XYCOM documentation a year ago
- XY560App opi cleanup after color naming changes 10 months ago
- asymApp asymApp: opi cleanup after color naming changes 10 months ago
- beam_stopperApp stopper.opi: update 7 months ago
- bomApp bomApp: removed macro in comment, it was creating warning... a year ago
- btaApp bta, struckDaq: latest import from HPS 9 months ago
- c370App c370App: playing with setup 6 months ago
- cRioApp beast: added beast file_type to build system 26 minutes ago
- caenHvApp Merge branch 'hotfix-v1.3.3' of https://github.com/jeffersonla... 17 days ago
- cagwApp cagwApp: added to read PVs off a CA gateway on another subnet 5 months ago
- casApp casApp: made cas.db a template and added basic gui 4 months ago
- chillerApp css: minor opi updates 8 months ago
- clasTreeApp commit some deletions a month ago
- class1App class1App: added all required dbd's and lib's a year ago
- class3App documented more XY560 channels a year ago
- class4App Makefile cleanup/organization a year ago
- class6App class6/8: latest import from HPS 9 months ago
- class8App class6/8: latest import from HPS 9 months ago
- configure beast: added beast file_type to build system 26 minutes ago
- dynabcApp dynabcApp: updated opis a year ago
- fcup_gainApp fcup_gainApp: cleaned up db's a year ago
- frwd_scalerApp frwd_scalerApp: converted adf's to opi's a year ago
- ftntkApp ftntkApp/Db: add comment a month ago
- ftFlasherApp another flasher script 5 months ago
- fthDividerApp Updates to clasTreeApp plus new apps genFlasherApp and fthD... 6 months ago
- genFlasherApp genFlasherApp/op/opi: remove default P macro, because overr... 5 months ago
- harp_genericApp harp gui updates 7 months ago
- iocBoot procServ.conf: added solenoid IOCs and test iocclonpc11 16 minutes ago
- jscalerApp jscalerApp: ecal slot mapping was incorrect, fix crate numberin... 10 days ago
- jscalerDrvApp jscalerDrvApp: add 3 months ago
- keithley2001App keithley2001App updates 4 months ago
- keithley6221App add keithley6221App from hps 4 months ago
- kepcoApp kepcoApp: imported from clas a year ago
- minitorusApp minitorus: added notes a year ago
- moeller_targetApp moellerTargetApp: adding new app, currently standalone but t... 4 months ago
- mollerSetupApp Makefile cleanup/organization a year ago
- monitorApp monitorApp/hv_status*.opi: resize 16 days ago
- mpodLvApp ftlvt: add 3rd channel 13 days ago
- omegaCYD218App omegaCYD218: add linear option 7 months ago
- pcMonitorApp pcMonitorApp: test gui cleanup 10 days ago
- picApp picApp: added torus_bo_renamed.db 14 minutes ago
- prologixApp prologixApp: changes during DCLV commissioning a month ago
- rasterApp rasterApp: cleaned up db a year ago
- scalerApp opi touch-ups 10 months ago
- scripts add utility scripts for gpib-eth converter commissioning 25 days ago
- sensorProbeApp sensProbeApp -> sensorProbeApp 9 months ago
- sixtyHzApp opi cleanup after color naming changes 10 months ago
- struckDaqApp bta, struckDaq: latest import from HPS 9 months ago
- sy2604App sy2604.db: fix vout-<->imon swap 3 months ago
- syXS27App syXS27App/sy1527.c: add 1737 and 1536 boards (still need to... a month ago
- taggerTempApp taggerTempApp: imported from clas, renamed xy560.db to tag... a year ago
- vmeCratesApp vmeCratesApp: trigger a readback 16 days ago
- wf2rootApp wf2rootApp: changed text update to display bytes 5 days ago
- .gitignore beast: added beast file_type to build system 26 minutes ago
- Makefile Added deps for clasTreeApp to apps/Makefile file 6 months ago
- css_builder.sh Changes to implement clasTree view of EPICS 11 months ago
- css_launcher.sh css_launcher.sh: removed commented out lines 4 months ago



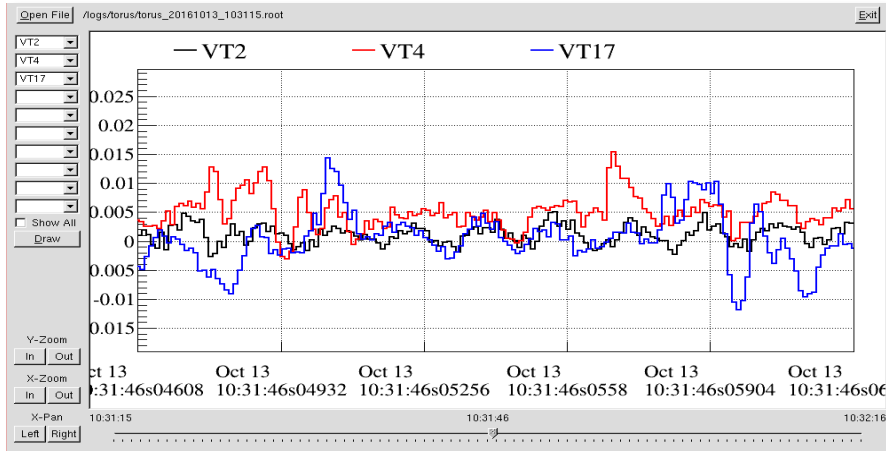
EPICS Hardware Support in Hall-B

- CAEN & Wiener HV/LV (detectors & beamline)
- VME Crates (from CLAS6 slow controls: classc#)
 - vxWorks OS
 - OMS Stepper Motors (harps, collimators)
 - Beamline Scalers (Jorger, Struck)
 - Old Magnets' PS (xycom) (HPS, Moller polarimeter)
 - Terminal servers for remote reset
- VXS Crates (DAQ: adcfToF#, tdcecal#...)
 - Linux OS (centos5)
 - EPICS: temperature, fans, status, remote reboot, FADC/DISC scalers
- XPS Motor Controllers (harps, collimators)
- National Instruments' CompactRIOs (Gas system & SC Magnets)
- Allen Bradley PLCs (SC Magnets)
- Prologix GPIB-ETH converters (DCLV)
- MOXA serial-eth converters (various, RS232/422/485)
- Omega Digital Transmitters (Thermocouples, RTDs)
- Anova/Lauda Chillers
- Agilent/Kiethley LV supplies (DCLV,HPS)
- LED Controllers (INFN and JLab modules)
- AKCP Weather Sensors (Hall-B)
- SCE410 Power Supply (Moller Helmholtz)
- Keithley DMMs (Faraday Cup, Moller Calib)
- MM FEB* and Siemens PLC*
- ...



Recent Progress (1)

- Torus Commissioning
 - EPICS Fast DAQ
 - 24 Voltage taps at 10 kHz → 4 GB/hr, with automatic transfer to tape
 - ROOT analyzer GUI
 - Various EPICS updates
 - Interlock monitoring improvements
 - Force sums and alarm updates
 - Hall-B buffer dewar IOCs alive (ops) and screens ported to CS-Studio
 - Analysis of archive force data in support of cooldown
- Torus controls improvements winding down, solenoid controls gearing up



Torus MPS Interlock Status - PLC

Fast Dump Interlocks	MPS Internal Interlocks	PLC Controlled Ramp Down
LHe Liquid Level	Internal Summation (Danfysk)	Axial Support SG
Vapor Cooled Lead Temp	Transistor	DS Hex Beam SG
Chassis Watchdog	DC Overcurrent	US Hex Beam SG
Current Lead Water Flow	DC Overload	CCM Load Cell
VT Cable Intlk	Regulation Module	Vertical Support
System Cable Intlk	Pre-regulator	SW Quench
QD_Sum1 (ch1-4). dv>100mv	Phase (AC)	Vacuum
QD_Sum2 (ch5-8). dv>100mv/80mv	MPS Waterflow	EPICS Watchdog
QD_Sum3 (ch9). dv>200mv	Ground Fault (leakage)	CryoLHe LL/Pres.LN2.LN2.Pres.VCL.Vif/TI
PLC Fast Dump Sum	Thermal Breaker	SW Current Limit (EPICS)
EPICS Fast Dump Button	MPS Overtemperature	sRIO FastDAQ Comm
Current Limit	E-Stop/Door Switch	Splice(s) Over Temp
Ramp Down Fail		
VESDA Fire Detection		
SW Quench, 2nd Threshold		
UPS Battery Low		
ESR Fault		

Warnings (Not Interlocked)

sRIO Comm	CryoCon 2
CryoCon 1	CryoCon 3

Resets

Set to Local, REMOTE, Reset MPS, Reset PLC, Reset CryoCons

Torus MPS Control

Turn OFF MPS, Stop Ramp, Status Rdbk: ON, DAQ Rec: WRITING

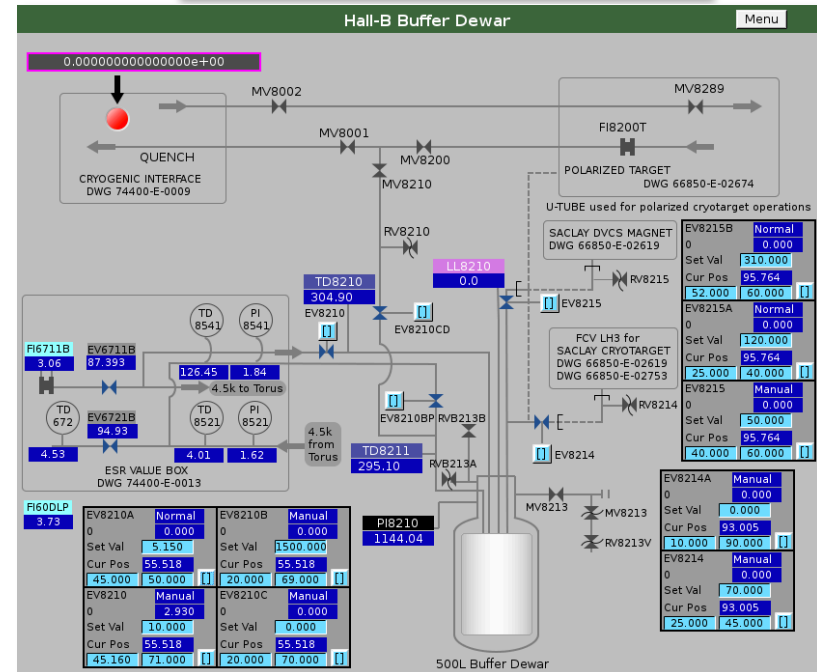
Setpoint: 2000.00 A, Slew: 1000 mA/s, MAX (sw/hw): 2020.00 A

Hall Sensors:

CCM A	10689.08 G
CCM B	10622.14 G
CCM C	10779.12 G
CCM D	11058.82 G
CCM E	10512.12 G
CCM F	11085.88 G

Current (MPS): 1995.98 A, Current (ZFCT): 1997.45 A, Voltage: 0.72 V, Polarity: POSITIVE, Field Direction: CCW

Buttons: Fast Dump, Reset Interlocks, Reset COMM, Local/Remote (Set to Local, REMOTE)



Recent Progress (2)

- DC LV controls ~complete
 - with alarms and archived in MYA, GUIs in cs-studio
 - required investigations & blocking non-EPICS traffic at network switch in Hall-B (unecessary in previous tests in EEL)
 - Prologix GPIB-ETH converters can't handle broadcast traffic volume on Hall-B slow controls subnet
 - standard EPICS softIOC, no LabView/Windows
 - very good response time (<<1s) and reliability
 - 1 bad power supply remaining

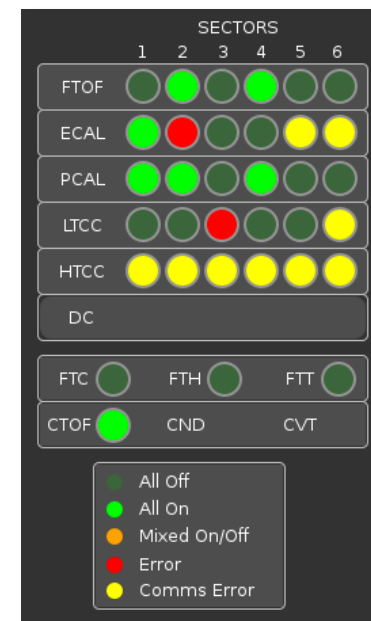
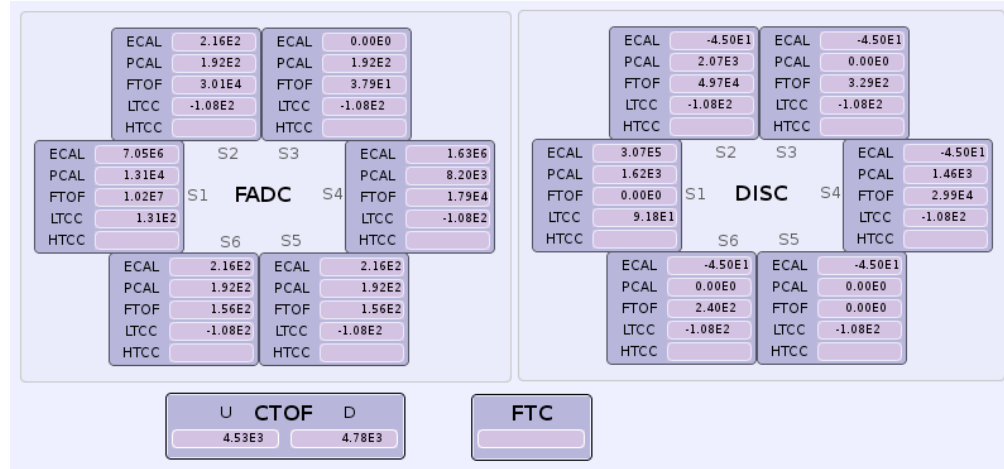
Novice DC Low Voltage										
			Measured		Setpoint		Input		OVC	
Channel	Pw	Status	Voltage	Current	Voltage	Current	Voltage	Current		Reset
S1 R1	ON	ON	7.50 V	0.47 A	7.50 V	38.00 A	7.50 V	38.00 A		Reset
S1 R2	ON	ON	7.00 V	-0.01 A	7.00 V	40.01 A	7.00 V	40.01 A		Reset
S1 R3	ON	ON	8.00 V	0.00 A	8.00 V	20.00 A	8.00 V	20.00 A		Reset
S2 R1	ON	ON	7.50 V	0.50 A	7.50 V	23.01 A	7.50 V	23.01 A		Reset
S2 R2	ON	ON	7.50 V	0.00 A	7.50 V	42.00 A	7.50 V	42.00 A		Reset
S2 R3	ON	ON	8.00 V	-0.00 A	8.00 V	20.00 A	8.00 V	20.00 A		Reset
S3 R1	ON	ON	7.50 V	0.01 A	7.50 V	23.00 A	7.50 V	23.00 A		Reset
S3 R2	ON	ON	7.50 V	-0.02 A	7.50 V	37.00 A	7.50 V	37.00 A		Reset
S3 R3	ON	ON	7.25 V	-0.00 A	7.25 V	36.00 A	7.25 V	36.00 A		Reset
S4 R1	ON	ON	0.55 V	0.01 A	8.00 V	29.00 A	8.00 V	29.00 A		Reset
S4 R2	ON	ON	7.25 V	0.01 A	7.25 V	36.00 A	7.25 V	36.00 A		Reset
S4 R3	ON	ON	7.50 V	-0.01 A	7.50 V	23.00 A	7.50 V	23.00 A		Reset
S5 R1	ON	ON	7.20 V	0.01 A	7.20 V	42.00 A	7.20 V	42.00 A		Reset
S5 R2	ON	ON	7.50 V	-0.01 A	7.50 V	21.00 A	7.50 V	21.00 A		Reset
S5 R3	ON	ON	7.20 V	0.01 A	7.20 V	42.00 A	7.20 V	42.00 A		Reset
S6 R1	ON	ON	0.63 V	1000000000	8.00 V	30.21 A	8.00 V	30.21 A		Reset
S6 R2	ON	ON	8.00 V	0.00 A	8.00 V	43.00 A	8.00 V	43.00 A		Reset
S6 R3	ON	ON	8.00 V	-0.01 A	8.00 V	36.00 A	8.00 V	36.00 A		Reset

DC LV Alarm Settings									
Current									
Channel	Value	LOLO	LO	HI	HIHI	LOLO	LO	HI	HIHI
S1 R1	-0.00 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S1 R2	-0.01 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S1 R3	0.00 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S2 R1	-0.01 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S2 R2	0.00 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S2 R3	-0.00 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S3 R1	-0.00 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S3 R2	-0.01 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S3 R3	-0.00 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S4 R1	0.01 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S4 R2	0.01 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S4 R3	-0.01 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S5 R1	0.00 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S5 R2	9.29 A	7.00 A	8.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S5 R3	-0.00 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S6 R1	-0.01 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S6 R2	9.29 A	7.00 A	8.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR
S6 R3	-0.01 A	16.00 A	17.00 A	19.00 A	20.00 A	MAJOR	MINOR	MINOR	MAJOR

Voltage									
Channel	Value	LOLO	LO	HI	HIHI	LOLO	LO	HI	HIHI
S1 R1	-0.00 V	5.00 V	6.00 V	8.00 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S1 R2	-0.01 V	5.00 V	6.00 V	8.00 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S1 R3	-0.00 V	5.00 V	6.00 V	8.00 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S2 R1	-0.00 V	5.00 V	6.00 V	8.00 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S2 R2	-0.00 V	5.00 V	6.00 V	8.00 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S2 R3	-0.01 V	5.00 V	6.00 V	8.50 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S3 R1	-0.00 V	5.00 V	6.00 V	8.00 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S3 R2	-0.00 V	5.00 V	6.00 V	8.00 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S3 R3	-0.01 V	5.00 V	6.00 V	8.00 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S4 R1	0.55 V	5.00 V	6.00 V	8.50 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S4 R2	-0.00 V	5.00 V	6.00 V	8.00 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S4 R3	-0.00 V	5.00 V	6.00 V	8.00 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S5 R1	-0.00 V	5.00 V	6.00 V	8.00 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S5 R2	7.50 V	5.00 V	6.00 V	8.00 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S5 R3	-0.00 V	5.00 V	6.00 V	8.00 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S6 R1	-0.00 V	5.00 V	6.00 V	8.00 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S6 R2	7.20 V	5.00 V	6.00 V	8.50 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR
S6 R3	-0.00 V	5.00 V	6.00 V	8.00 V	9.00 V	MAJOR	MINOR	MINOR	MAJOR

Recent Progress (3)

- HV system
 - Forward carriage archived in MYA
 - Global statuses (@ sector/detector/group levels)
 - DC current sums by region
- Scalers
 - Forward carriage detectors done
 - With sector/layer/region sums
- Forward Tagger
 - Complete except MM FEB and PLC, in progress
- cRio Heartbeats and Alarms
- IOCs / servers recovery procedure exercised
 - Due to opportunistic power outage / UPS failures
 - Automatic recovery >95% success, with lessons learned
- Hardware Repairs
 - CAEN HV
 - A couple more HV board failures and repairs
 - CPU & power supplies repaired under newly extended warranty
 - MOXA serial-eth servers
 - mfg. acknowledged batch of hardware failures and repaired at no cost (warranty expired)



Upcoming Work

November 2016 (required for KPP)

- DC HV Controls
 - final test of full 6-sector controls in Hall-B
 - *pending install of serial lines*
 - software/GUIs already tested on 1 mainframe in EEL & Hall-B
- Add all alarms to handler
 - been running for months with torus alarms and a few detector gas alarms
- CLAS12 Overview screen(s)
- Solenoid Controls*

Next

- Finish CND/MM integration
 - CND-specific HV Controls (already tested)
 - MM FEB and PLC
- Saclay Cryotarget → EPICS
 - delayed by PLC issues
- Moller Polarimeter
 - target calibration started last summer
- Cameras / weather sensors
- DAQ integration
- Logbook integration
- SVT integration

