Overview

**Organization**
- N. Baltzell, K. Livingston, B. McKinnon, W. Moore
- Biweekly Meetings: 9:00 on Fridays in L210A
  - With meeting agendas and minutes, planning docs, subsystem specs, improving documentation
- **First goal:** KPP, full baseline support by summer's end
- Working with DAQ and Detector Support Groups for integration (esp. J. Ballard, S. Boyarinov, B. Eng, G. Jacobs)

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

**Framework**
- Everything in EPICS (R3.14.12.15)
- CS-Studio for user interface
- BEAST alarm system (databases+servers+clients)
- JLab's MYA Archiving
Hall-B Servers/PCs

**Linux**
- Hall-B Counting House
  - NetApp filesystem clonfs1 (/home, /usr/clas12, ...)
  - Rackmounted
    - SoftIOC EPICS servers (clonioc1-4)
    - Alarm server, Notifier, EPICS gateway (clondb3)
    - Multipurpose / Remote usage (clonsl1-3)
    - Higher performance DAQ machines (clondaq3-6)
- PCs
  - Shifters’ workstations (clonpc11-19)
  - Torus/Solenoid Commissioning workstations (clonpc20-22)
  - Dual monitor, future upgrade to 2x2
- Mya Archiver (ops)
- WebOPI/VDI VMs (IT)

**Windows PCs**
- Saclay Target Workstations
  - Hardware upgraded by Saclay in 2015 (fanless)
  - 3rd floor Space Frame and one in Counting House
  - Directly connected to PLC via FIP network
  - For Target Experts

**Mac Minis** (clonxt##)
- Clients only (e.g. web browser, ssh)
  - Recently upgraded to modern OSX
- Hall-B (Entrance, Forward Carriage (3), Pie Tower)
- EEL & Test Lab (various detector areas)

Software / IT

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

- On Hall-B counting house machines, users operate from /usr/clas12/release/pro, a github hotfix build

- 64bit RHEL7 Operating Systems
  - One RHEL6 and one 32bit RHEL5 still lingering for safety, disappearing soon

- Server/workstation installs and configurations are deployed and managed with Puppet by JLab IT

- And monitored with Nagios by JLab IT
  - cpu/disk/memory usage
  - automatic emails on overuse
  - ensure certain software is running on particular machines
  - alarm server, notifier, gateway
**“I/O” Hardware**

- **VME Crates** (from CLAS6 slow controls: classc#)
  - vxWorks OS
  - OMS Stepper Motor controllers (harps, collimators)
  - Beamline Scalars (Jorger, Struck)
  - Old Magnets’ PS (xycom) (HPS, Moller polarimeter)
  - Terminal servers for remote reset
  - Some decommissioning, moving apps to softiocs

- **VXS Crates** (DAQ: adcftof#, tdcecal#...)
  - Linux OS (currently centos5)
  - EPICS: temperature, fans, status, remote reboot, FADC/DISC scalers

- **XPS Motor Controllers** (harps, collimators)
- **CompactRIO** (Gas system)
- **Allen Bradley PLC** (SC Magnets)
- **GPIB-ETH converters** (DCLV)
- **MOXA serial-eth converters** (various, RS232/422/485)
- **Omega Digital Transmitters** (Thermocouples, RTDs)
- **Anova/Lauda Chillers**
- **Flasher Controllers** (CTOF, HTCC, FTC, FTH)
- **AKCP Weather Monitors**
- …
HV/LV Hardware

**HV**
- **CAEN SY1527/4527** (mfg's API)
  - CTOF, ECAL, FTC, FTT*, FTH*, FTOF, HTCC, LTCC, PCAL, Beamline (16)
  - Various Modules
  - A few board failures
- **CAEN 527** (CANBUS)
  - DC (4), CND* (1)
- **MPOD** (snmp)
  - SVT, MicroMegas*

**LV**
- **CAEN SY2604** (asyn)
  - HTCC (CCoils)
- **MPOD** (snmp)
  - CTOF (CCoils)*
  - SVT
  - MicroMegas*
  - FTC

* = still needs work
CS-Studio

- More powerful / flexible than medm or edm
  - Allows a more unified user-interface, faster development
- Java Eclipse based (linux/mac/windows)
- Used by Hall-D, and SNS, BNL, FRIB, DESY, ITER, …
- Built in alarm handler, data browser, and much more
BEAST Alarm System

- Alarm, Notifier, Messaging servers and associated databases
  - Running on clondb3
  - Notifications (automatic emails) happen on server

- Client Alarm Handler and “Annunciator”
  - Audible/Visible alarms built into CS-Studio

- Alarms history logged to database & retrievable from CS-Studio

- Currently running for gas & torus systems
High Voltage

- All CAEN hardware (SY4527/1527/527 mainframes, various boards)
- GUIs for easy status viewing, global on/off, geometric representation
- Easy access to single channel and regional controls
Low Voltage

- EPICS & GUI support for DC and HTCC LV ready
  - Aglient 6551 / CAEN SY2604
- Add CTOF and MMs soon

### DC Low Voltage

<table>
<thead>
<tr>
<th>Channel</th>
<th>Status</th>
<th>Voltage</th>
<th>Current</th>
<th>Voltage</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>S5 R1</td>
<td>ON</td>
<td>7.00</td>
<td>18.25</td>
<td>7.00</td>
<td>20.00</td>
</tr>
<tr>
<td>S5 R1</td>
<td>ON</td>
<td>7.00</td>
<td>18.25</td>
<td>7.00</td>
<td>20.00</td>
</tr>
<tr>
<td>S5 R1</td>
<td>ON</td>
<td>7.00</td>
<td>18.25</td>
<td>7.00</td>
<td>20.00</td>
</tr>
<tr>
<td>S5 R1</td>
<td>ON</td>
<td>7.00</td>
<td>18.25</td>
<td>7.00</td>
<td>20.00</td>
</tr>
<tr>
<td>S5 R1</td>
<td>ON</td>
<td>7.00</td>
<td>18.25</td>
<td>7.00</td>
<td>20.00</td>
</tr>
<tr>
<td>S5 R1</td>
<td>ON</td>
<td>7.00</td>
<td>18.25</td>
<td>7.00</td>
<td>20.00</td>
</tr>
<tr>
<td>S5 R1</td>
<td>ON</td>
<td>7.00</td>
<td>18.25</td>
<td>7.00</td>
<td>20.00</td>
</tr>
<tr>
<td>S5 R1</td>
<td>ON</td>
<td>7.00</td>
<td>18.25</td>
<td>7.00</td>
<td>20.00</td>
</tr>
<tr>
<td>S5 R1</td>
<td>ON</td>
<td>7.00</td>
<td>18.25</td>
<td>7.00</td>
<td>20.00</td>
</tr>
<tr>
<td>S5 R1</td>
<td>ON</td>
<td>7.00</td>
<td>18.25</td>
<td>7.00</td>
<td>20.00</td>
</tr>
</tbody>
</table>

### HTCC Compensation Coil Voltages

<table>
<thead>
<tr>
<th>Channel</th>
<th>Status</th>
<th>Pw Set</th>
<th>Imon</th>
<th>Isat</th>
<th>VIN</th>
<th>VC</th>
<th>TS</th>
<th>TS</th>
</tr>
</thead>
<tbody>
<tr>
<td>htclvl</td>
<td>OFF</td>
<td>OFF</td>
<td>0.0</td>
<td>0.0</td>
<td>12.0</td>
<td>0.0</td>
<td>31.9</td>
<td>35.2</td>
</tr>
<tr>
<td>htclvl</td>
<td>OFF</td>
<td>OFF</td>
<td>0.0</td>
<td>0.0</td>
<td>12.0</td>
<td>0.0</td>
<td>31.9</td>
<td>35.2</td>
</tr>
<tr>
<td>htclvl</td>
<td>OFF</td>
<td>OFF</td>
<td>0.0</td>
<td>0.0</td>
<td>12.0</td>
<td>0.0</td>
<td>31.9</td>
<td>35.2</td>
</tr>
<tr>
<td>htclvl</td>
<td>OFF</td>
<td>OFF</td>
<td>0.0</td>
<td>0.0</td>
<td>12.0</td>
<td>0.0</td>
<td>31.9</td>
<td>35.2</td>
</tr>
<tr>
<td>htclvl</td>
<td>OFF</td>
<td>OFF</td>
<td>0.0</td>
<td>0.0</td>
<td>12.0</td>
<td>0.0</td>
<td>31.9</td>
<td>35.2</td>
</tr>
<tr>
<td>htclvl</td>
<td>OFF</td>
<td>OFF</td>
<td>0.0</td>
<td>0.0</td>
<td>12.0</td>
<td>0.0</td>
<td>31.9</td>
<td>35.2</td>
</tr>
<tr>
<td>htclvl</td>
<td>OFF</td>
<td>OFF</td>
<td>0.0</td>
<td>0.0</td>
<td>12.0</td>
<td>0.0</td>
<td>31.9</td>
<td>35.2</td>
</tr>
</tbody>
</table>
Detector Overview Screens

- At request of detector groups
- Combined HV, LV, Temp, Gas, Chillers, etc...
- Access to expert screens for each subsystem

N. Baltzell, CLAS12 Clow Controls: 3rd 1st CLAS12 Experiment Workshop, June 15, 2016
Save/Restore Settings

- Accessible from detector’s screens
- Setup for most detectors’ HV/LV setpoints
  - voltage, current limits, trip time, and ramp rates
- Same old “burt backup” software
  - reads/writes 1000s of PVs in seconds
  - stored in ascii files on clonfs1 (fully backed up)
    - time-stamped filenames
  - just new interface
Gas System

- CompactRIO pushes to EPICS softIOC
- EPICS integration mostly complete
  - a few already alarms in use (HTCC, SVT)
- Bubbler cameras delivered, to be installed
Torus Power Supply

Allen-Bradley PLCs, interfaced with EPICS EtherIP driver. EPICS support and GUIs implemented and tested, according to DSG specs. Alarms in progress.

N. Baltzell, CLAS12 Clow Controls : 3rd 1st CLAS12 Experiment Workshop, June 15, 2016
Torus Vacuum Controls - PLC

Upper Torus Vacuum

Main Vacuum

Roots Vacuum

Values

Narb.

UCS

UPS in-Battery

ESR

Transfer Switch

Utility Panel

Panel

Open PV8101

Secondary Gate Valve

Pumping Rates

CGB102 (CC)

CGB103 (CC)

TCB102 (Pirani)

TCB103 (Pirani)

CGG100 (CC)

CGG100TB (CC)

TCG104RP (Pirani)

1.416-6 torr

4.71E-5 torr

2.39E-3 torr

2.67E-4 torr

4.49E-4 torr

7.11E-2 torr

TCB103 (Rate)

6.00 Torr/hr

6.00 Torr/hr

6.00 Torr/hr

6.00 Torr/hr

5.00 Torr/hr

5.00 Torr/hr

6.00 Torr/hr

6.00 Torr/hr

N. Baltzell, CLAS12 Clow Controls : 3rd 1st CLAS12 Experiment Workshop, June 15, 2016

Allen-Bradley→EPICS EtherIP and GUI support implemented and tested, according to DSG specs. Alarms running and in use.
Allen-Bradley → EPICS and GUI support implemented, according to expert specs. Alarms implemented & running.
Flashers

- EPICS Support Complete
  - JLab Flasher VME board
    - HTCC, CTOF
  - INFN standalone Flasher
    - FTC

---

N. Baltzell, CLAS12 Clow Controls : 3rd 1st CLAS12 Experiment Workshop, June 15, 2016
Tree/Search View

- **Navigate through entire system**
  - by detector/sector hierarchy
  - *with wildcard search*

- **Automatic graph generation**
  - currently focus on HV Current/Voltage
    - JLab scalers to be added soon
  - supplied by
    - python softIOC to generate EPICS waveform
    - CS-Studio Data Browser
Remote Monitoring

• Experimental operations must be read-only unless 2-factor authentication
  – Hall-B read-only EPICS channel access gateway up and running on clondb3

• Exploring web browser access
  – Without a terminal, ssh, X-forwarding
  – WebOPI will be useful for basic read-only monitoring
    • e.g. system overviews
    • Runs same GUI screens written for CS-Studio
    • https://hallbopi.jlab.org
      – 8 cores and 8 GB RAM, part of JLab’s VM pool
      – Scalability concerns (cpu, but memory footprint seems stable)
    – And VDI, which can provide full software tools, and write-access with 2-factor authentication

• Lack of Mya archive access from CS-Studio
  – MyaViewer and associated command line tools are currently the only option
    • not “easy” from offsite
  – Considering
    • running Hall-B archiver with ~week lookback time (easy)
    • implementing Mya access from CS-Studio (not easy)
Summary

• Much progress over past months and year
• En Route to KPP by summer’s end
• TODO items include:

  – Møller Polarimeter: refurbish hardware/software
  – Saclay Cryotarget → EPICS+CS-Studio
  – HV/LV tolerance monitoring in EPICS
  – MM/FTH/CND’s HV/LV/etc → EPICS

  – Adding all alarms (ongoing)
  – Adding to MYA archive (ongoing)
  – Exercise & choose “easy” offsite options (WebOPI, VDI, …)
  – Torus Slow Controls → Solenoid
  – Install cameras (delivered) and weather sensors (ordered)
  – Improve CLAS12 DAQ integration

  – Logbook Entries in CS-Studio
  – UI Layout / Design
  – SVT → CS-Studio
  – …
Motor Controls

Harp controls/sequencers exercised and updated with HPS.
DAQ Crates

snmp communications with all DAQ VXS crates integrated into EPICS and CS-Studio.
## IOC Health

### VME IOCs

<table>
<thead>
<tr>
<th>IOC Name</th>
<th>Hostname</th>
<th>Up Time</th>
<th>Heartbeat</th>
<th>Expert</th>
<th>Reboot</th>
<th>Last Reboot</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOCclass1</td>
<td>class1</td>
<td>10 days, 15:51:53</td>
<td>921113</td>
<td>reboot</td>
<td>04/07/2016 15:16:25</td>
<td></td>
</tr>
<tr>
<td>IOCclass4</td>
<td>class4</td>
<td>10 days, 18:57:26</td>
<td>922256</td>
<td>reboot</td>
<td>04/07/2016 12:10:30</td>
<td></td>
</tr>
<tr>
<td>IOCclass6</td>
<td>class6</td>
<td>4 days, 11:58:30</td>
<td>388711</td>
<td>reboot</td>
<td>04/13/2016 19:09:47</td>
<td></td>
</tr>
<tr>
<td>IOCclass8</td>
<td>class8</td>
<td>10 days, 21:80:48</td>
<td>941440</td>
<td>reboot</td>
<td>04/07/2016 09:37:30</td>
<td></td>
</tr>
</tbody>
</table>

### IOC Name

<table>
<thead>
<tr>
<th>IOC Name</th>
<th>Hostname</th>
<th>Up Time</th>
<th>Heartbeat</th>
<th>Expert</th>
<th>Reboot</th>
<th>Last Reboot</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOCclass1</td>
<td>class1</td>
<td>10 days, 15:51:53</td>
<td>921113</td>
<td>reboot</td>
<td>04/07/2016 15:16:25</td>
<td></td>
</tr>
<tr>
<td>IOCclass4</td>
<td>class4</td>
<td>10 days, 18:57:26</td>
<td>922256</td>
<td>reboot</td>
<td>04/07/2016 12:10:30</td>
<td></td>
</tr>
<tr>
<td>IOCclass6</td>
<td>class6</td>
<td>4 days, 11:58:30</td>
<td>388711</td>
<td>reboot</td>
<td>04/13/2016 19:09:47</td>
<td></td>
</tr>
<tr>
<td>IOCclass8</td>
<td>class8</td>
<td>10 days, 21:80:48</td>
<td>941440</td>
<td>reboot</td>
<td>04/07/2016 09:37:30</td>
<td></td>
</tr>
</tbody>
</table>

### IOC Status

#### IOCclass1
- Disconnected
- Disk Size: 12000GB
- Last Reboot: 06/01/2016 10:20:01

#### IOCclass4
- Disconnected
- Disk Size: 12000GB
- Last Reboot: 06/01/2016 10:20:01

#### IOCclass6
- Disconnected
- Disk Size: 12000GB
- Last Reboot: 06/01/2016 10:20:01

#### IOCclass8
- Disconnected
- Disk Size: 12000GB
- Last Reboot: 06/01/2016 10:20:01

---

N. Baltzell, CLAS12 Clow Controls : 3rd CLAS12 Experiment Workshop, June 15, 2016