JLab Hall B Controls: Infrastructure and IT Integration

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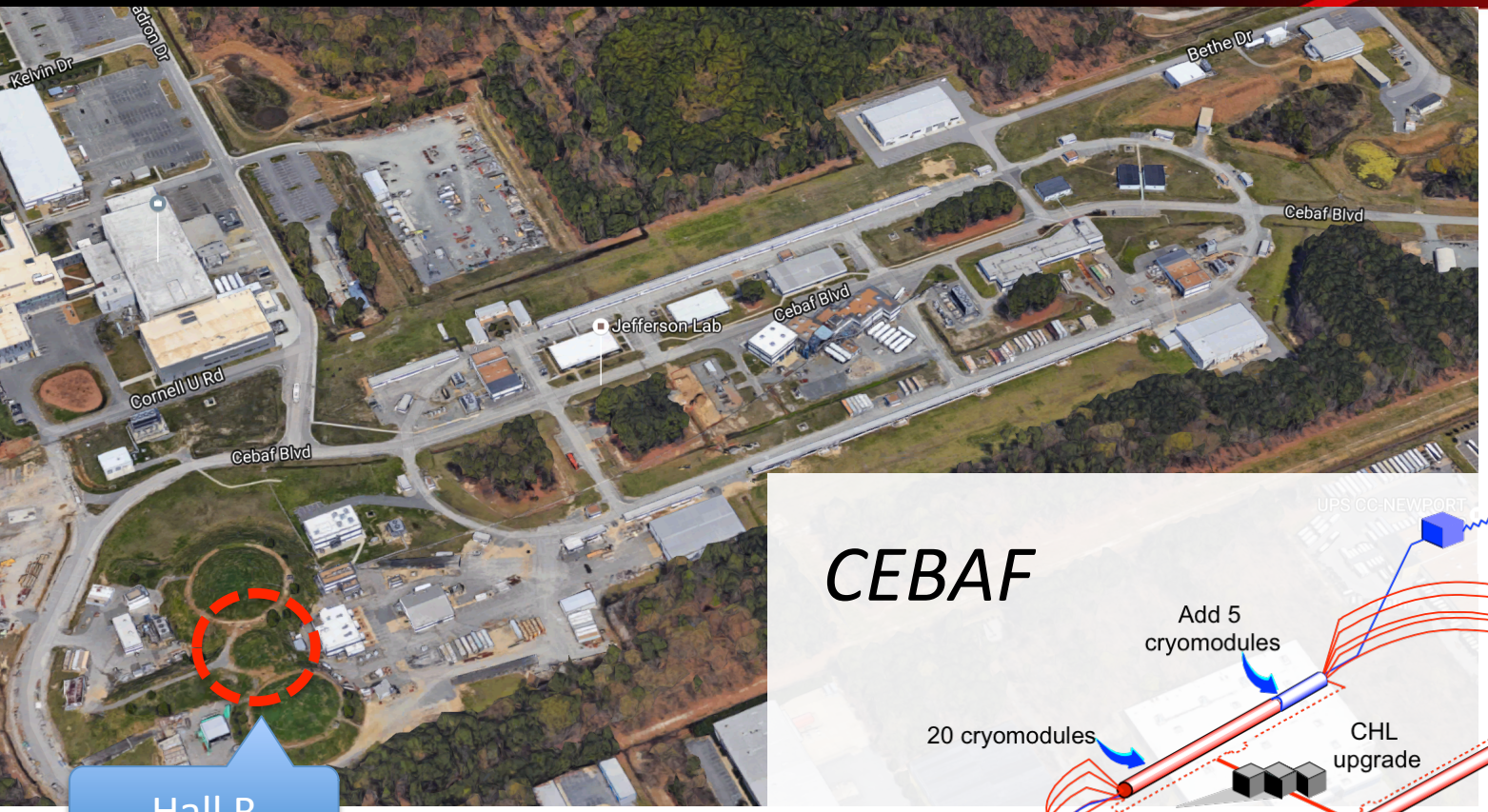
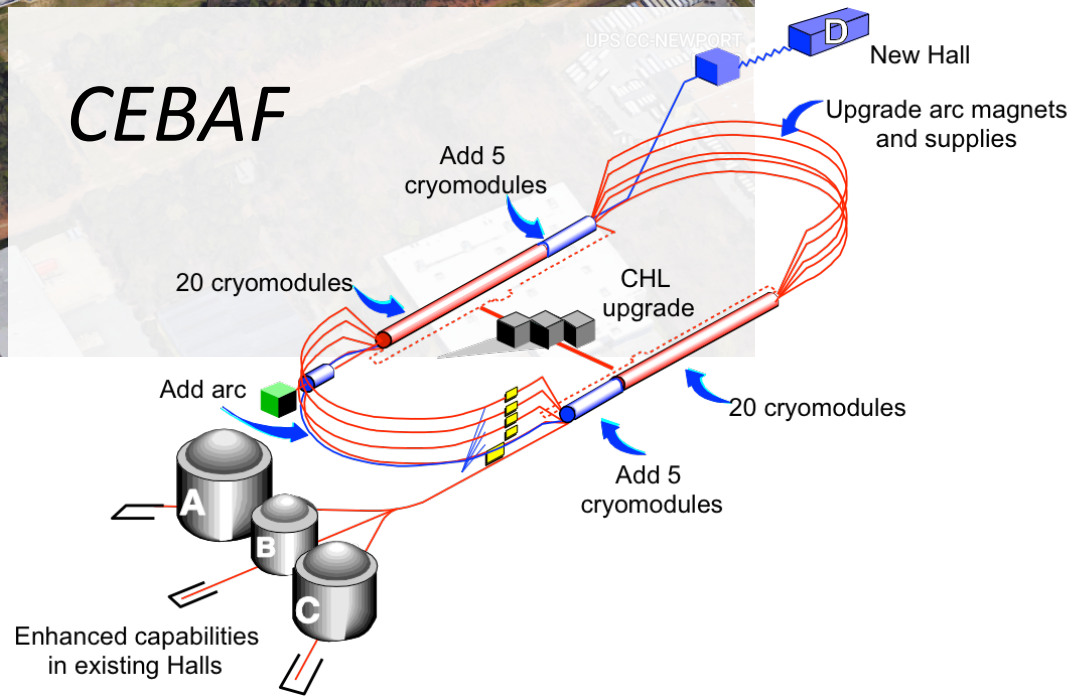
JLab CNI

Overview

- Hall B at JLab
- Migration to modern software
  - EPICS, GUIs, etc
- Useful utility scripts
- How we leveraged IT and security expertise
  - Host Management
  - Monitoring
  - Remote Access
- Future plans

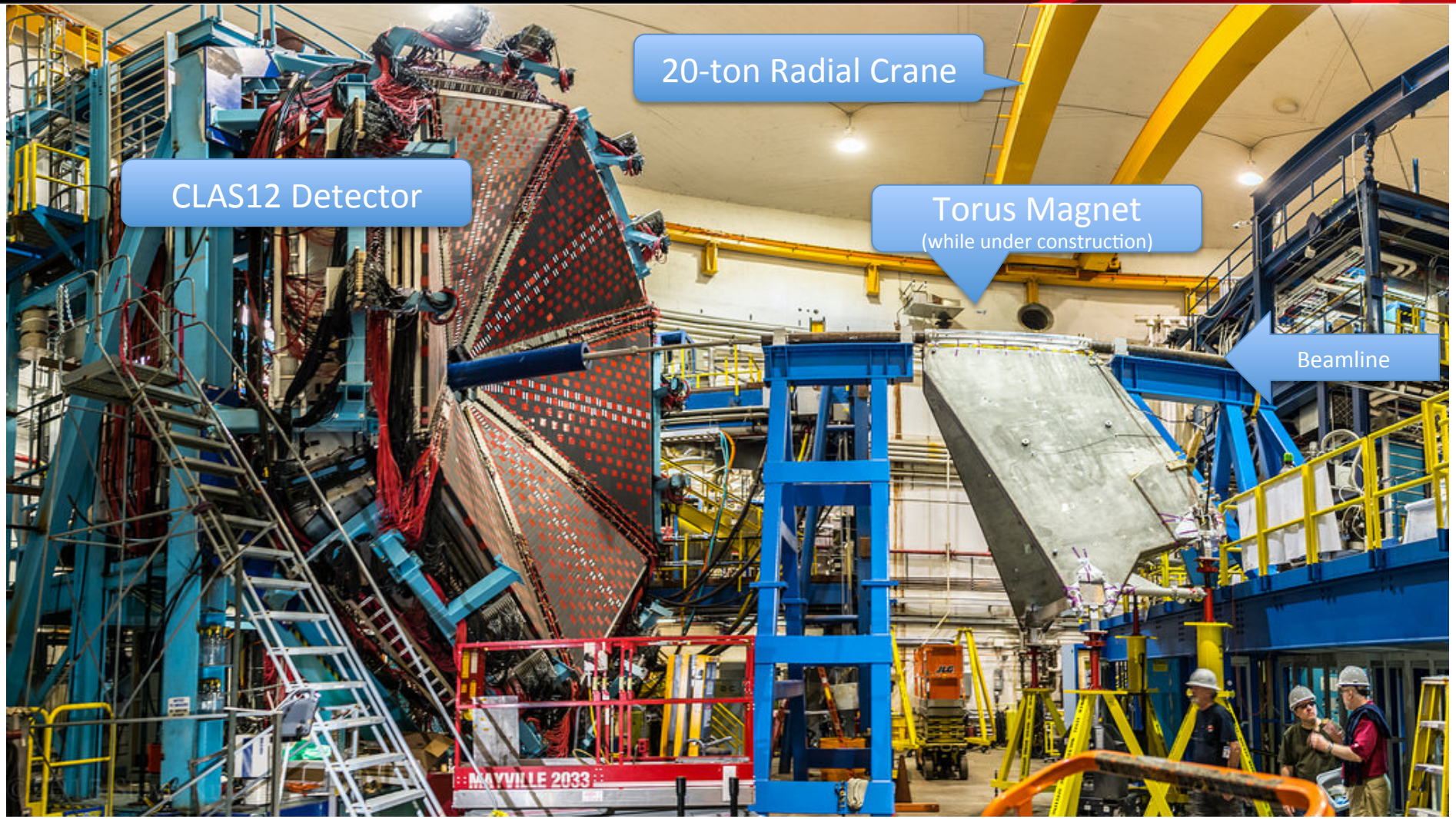
Hall B at JLab



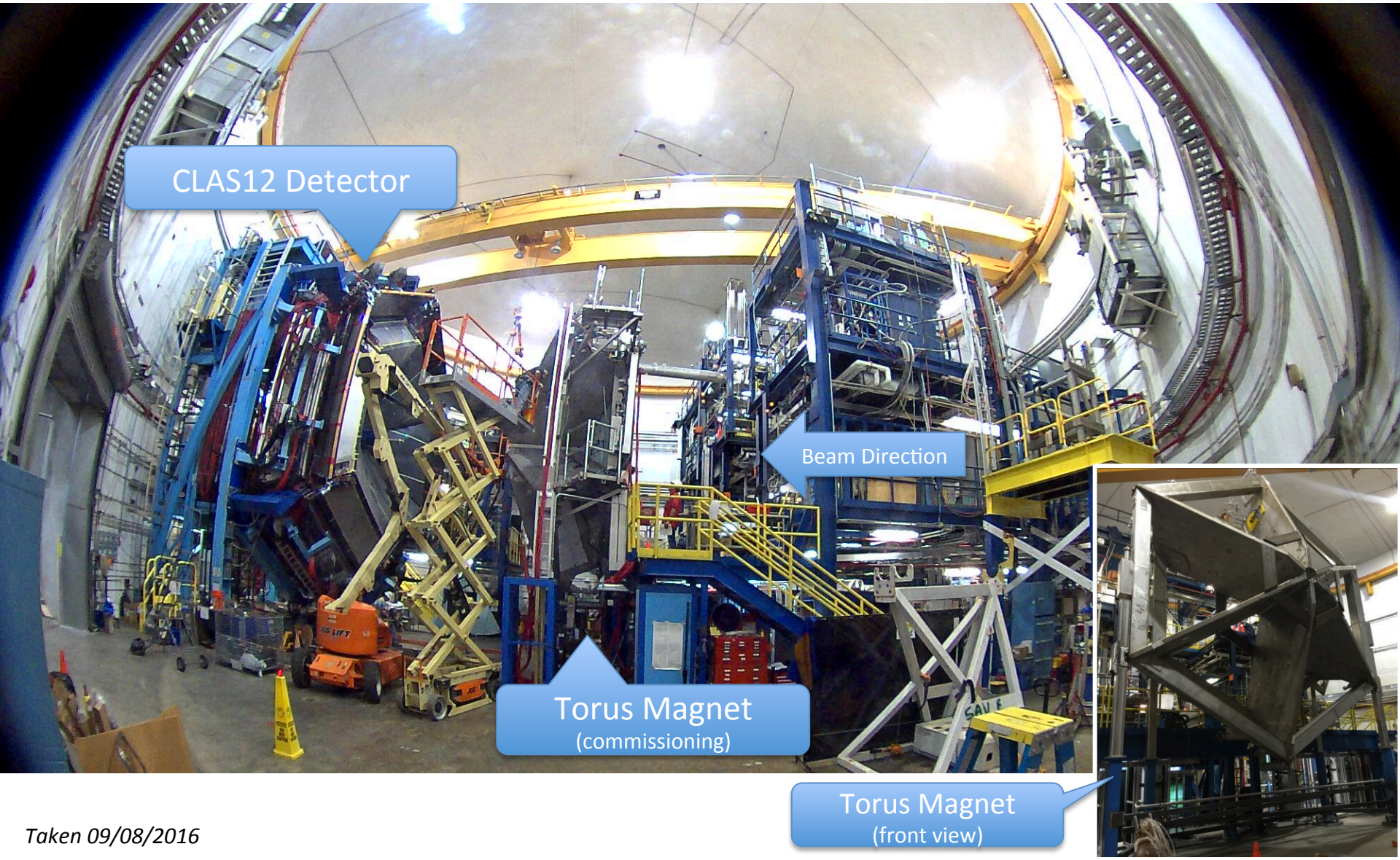


Google Maps: taken 09/08/2016

Hall B at JLab



Hall B at JLab



Taken 09/08/2016

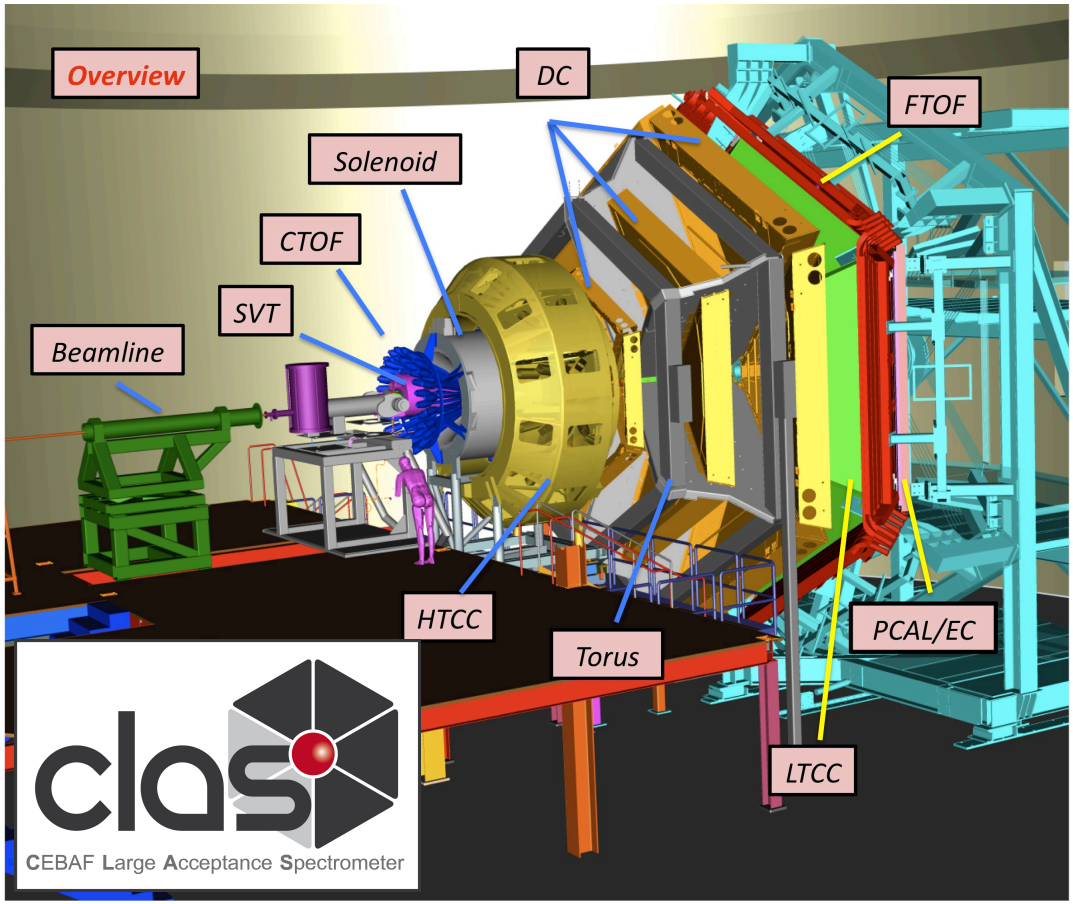
Hall B at JLab

Slow controls supports beamline, detectors, and experiments

>50 apps/drivers, >65 IOCs

Diverse subsystem support:

- Cryogenics (mostly PLC-based)
- Detectors, targets
- Magnets
- Vacuum
- Motors (collimators, harps, targets)
- Scalers
- Gas (He, N, etc)
- High/Low voltage
- Chillers



PRadius

Slow Controls Team:
Wesley Moore, Nathan Baltzell (JLab)
Ken Livingston, Bryan McKinnon (Glasgow)
PLC Programming:
Nicholas Sandoval, Pablo Campero (JLab)

EPICS

Before… *<2yr migration* After…

EPICS R3.13.4
- VME-centric (VxWorks)

MEDM 3.1.9

ALH

No web interfaces

CVS for ***most*** code
- Some with no version control

EPICS R3.14.12.5
- softIOC-centric (RHEL7 64-bit)

CS-Studio 4.1.1
- Wrapper script generates tmp workspace
- Open MEDM-style Menu or Alarm Perspective

BEAST/Notifier
- Some script generated configs

WebOPI
- Read-only gateway access
- Used for Management Staff and basic monitoring

Git for ***all*** code
- Branching (master, develop, hotfix)

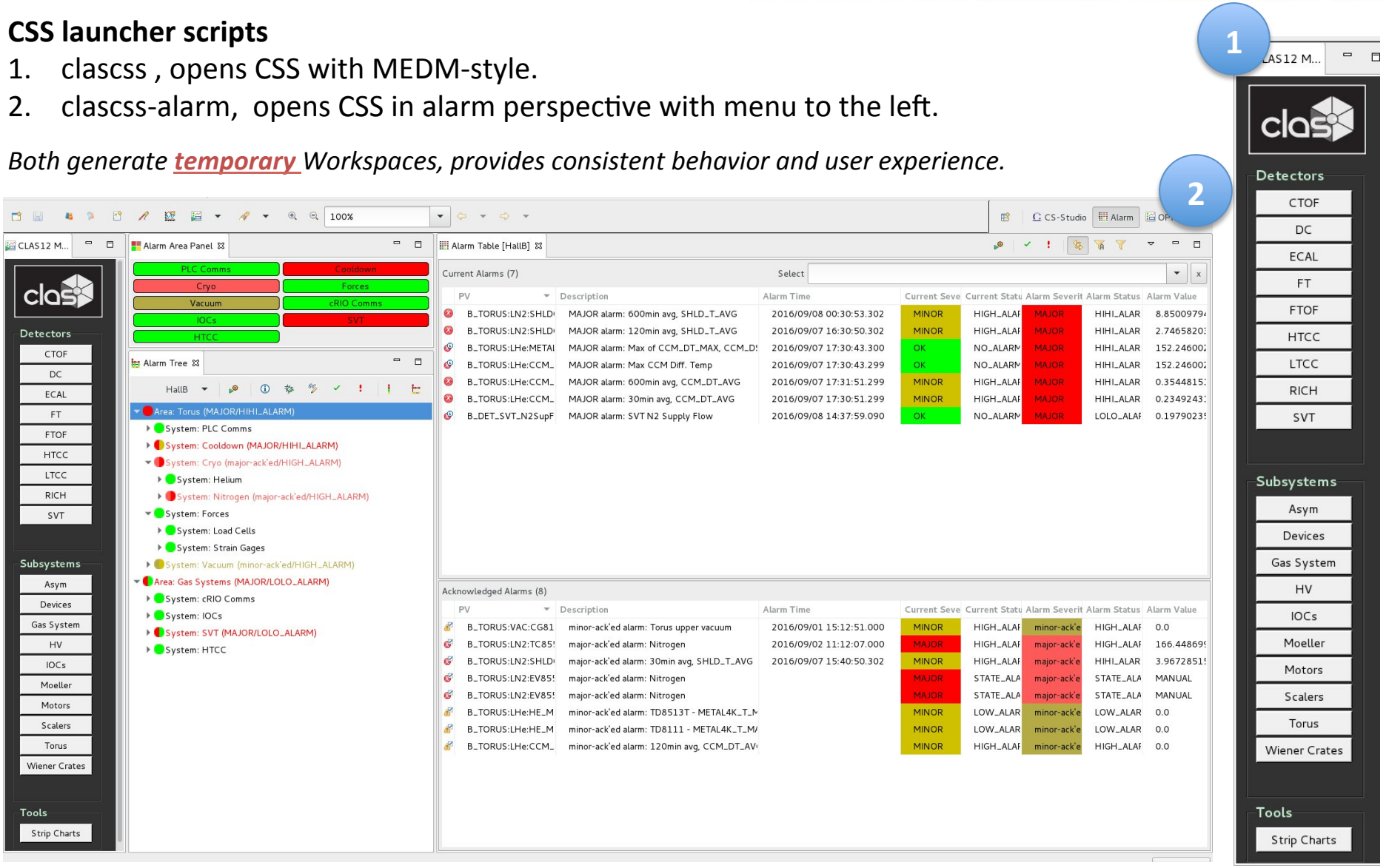
Archiving done with JLab's Mya Archiver/Viewer

CS-Studio

CSS launcher scripts

1. clascss , opens CSS with MEDM-style.
2. clascss-alarm, opens CSS in alarm perspective with menu to the left.

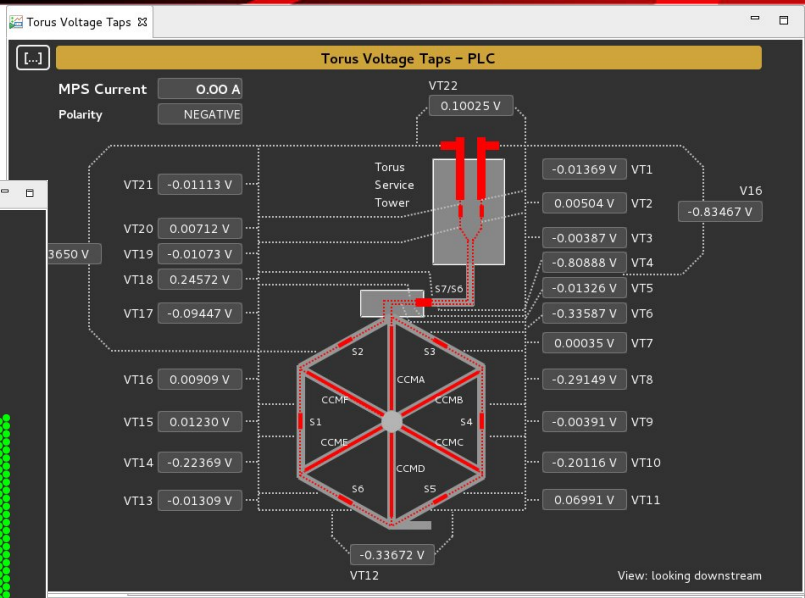
*Both generate **temporary** Workspaces, provides consistent behavior and user experience.*

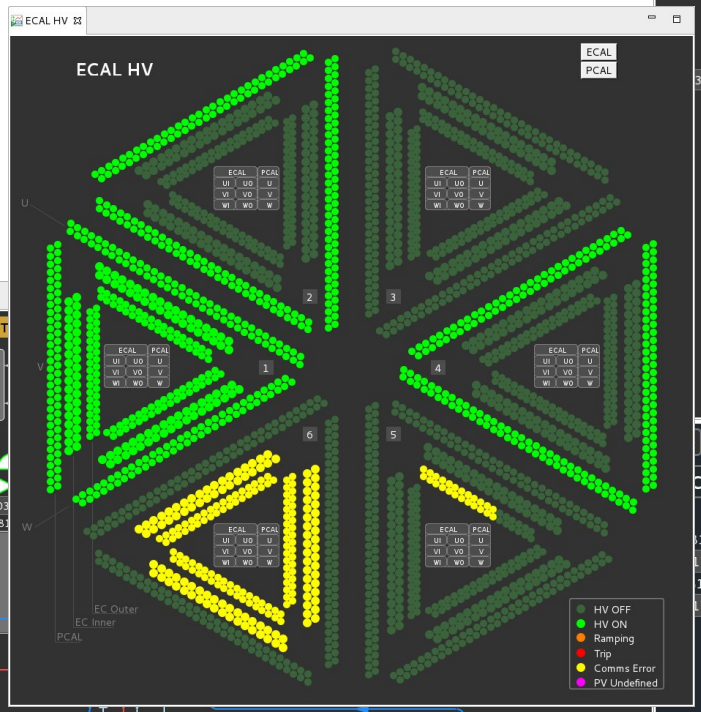


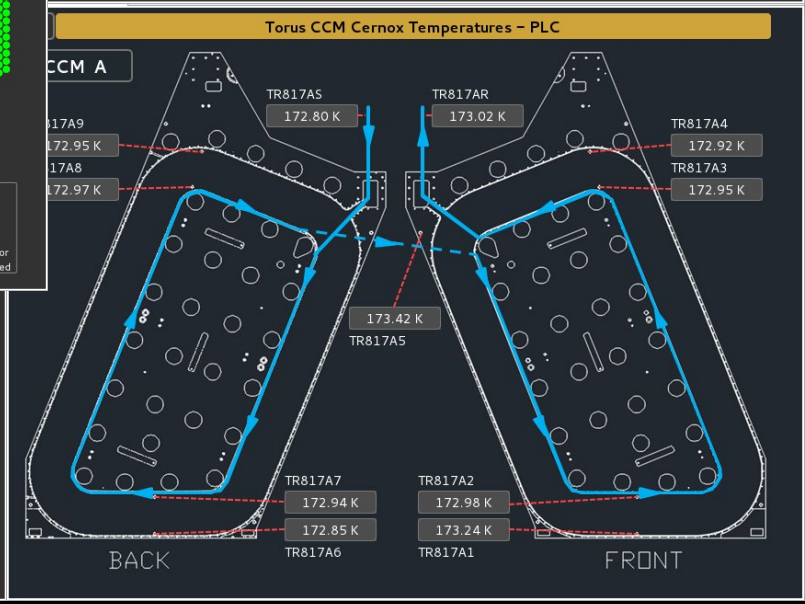
CS-Studio

GUIs a combination of:

- Script generation, internal and external to CSS
- Image overlays
- Hand drawn







WebOPI

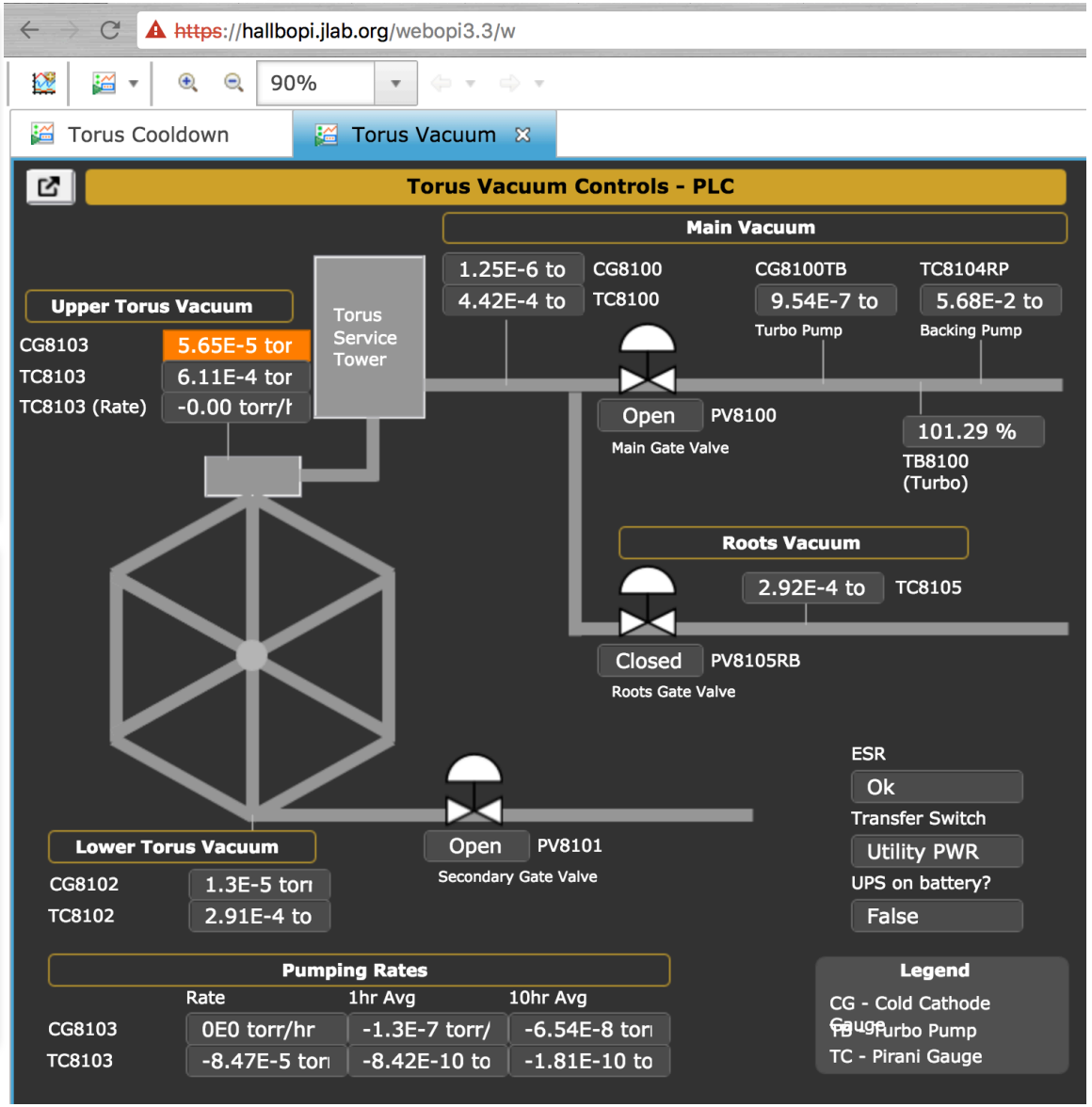
Configuration

- RHEL7 VM, 8-Core, 8GB
- Tomcat reverse proxyed behind Apache for access control.
- Firewall rules allow access to Read-only CA Gateway.
- Available off-site.

Findings

- Images with PVs didn't display.
- Have seen linked OPIs not resolve.
- Macro inheritance issues.
- Had to use relative paths, we copied our full CSS Share to webserver.
- font.def still needs tuning.

Apache/Tomcat: Marty Wise (JLab)



BEAST XML Generator

	A	B	C	D	E	F
	HallB	Torus	Vacuum			
	pv	description	latching	annunciating	display title	display details
	B_TORUS:VAC:CG8103	Torus upper vacuum	true	true	Open Vacuum GUI	/CLAS12_Share/apps/plcApp/torus_vacuum.opi
	B_TORUS:VAC:CG8103_RATE	CG8103 Rate	true	true	Open Vacuum GUI	/CLAS12_Share/apps/plcApp/torus_vacuum.opi
	B_TORUS:VAC:CG8103_AVG1HR	CG8103 1hr Avg	true	true	Open Vacuum GUI	/CLAS12_Share/apps/plcApp/torus_vacuum.opi
	B_TORUS:VAC:CG8103_AVG10HR	CG8103 10hr Avg	true	true	Open Vacuum GUI	/CLAS12_Share/apps/plcApp/torus_vacuum.opi
	B_TORUS:VAC:TC8103	Torus upper vacuum	true	true	Open Vacuum GUI	/CLAS12_Share/apps/plcApp/torus_vacuum.opi
	B_TORUS:VAC:TC8103_RATE	Torus upper vacuum pumping rat	true	true	Open Vacuum GUI	/CLAS12_Share/apps/plcApp/torus_vacuum.opi
	B_TORUS:VAC:TC8103_AVG1HR	TC8103 1hr Avg	true	true	Open Vacuum GUI	/CLAS12_Share/apps/plcApp/torus_vacuum.opi
	B_TORUS:VAC:TC8103_AVG10HR	TC8103 10hr Avg	true	true	Open Vacuum GUI	/CLAS12_Share/apps/plcApp/torus_vacuum.opi
	B_TORUS:VAC:CG8102	Torus lower vacuum	true	true	Open Vacuum GUI	/CLAS12_Share/apps/plcApp/torus_vacuum.opi
	B_TORUS:VAC:TC8102	Torus lower vacuum	true	true	Open Vacuum GUI	/CLAS12_Share/apps/plcApp/torus_vacuum.opi
	B_TORUS:VAC:PV8101	Torus secondary gate valve	true	true	Open Vacuum GUI	/CLAS12_Share/apps/plcApp/torus_vacuum.opi
	B_TORUS:VAC:CG8100	Torus main vacuum				
	B_TORUS:VAC:TC8100	Torus main vacuum				
	B_TORUS:VAC:CG8100TB	Torus main vacuum				
	B_TORUS:VAC:TC8104RP	Torus main vacuum				
	B_TORUS:VAC:TB8100	Torus main vacuum				
	B_TORUS:VAC:PV8100	Torus main gate valve				
	B_TORUS:VAC:TC8105	Torus roots vacuum				
	B_TORUS:VAC:PV8105RB	Torus roots gate valve				

csv2beast.py

- Import/export spreadsheet as CSV for convenience.
- CSV converted to BEAST XML.
- Sub-elements found by column headers.

Anyone have similar tools?

```
<?xml version="1.0" ?>
<config name="HallB">
    <!-- Generated by csv2beast.py -->
    <component name="Torus">
        <component name="Vacuum">
            <pv name="B_TORUS:VAC:CG8103">
                <description>Torus upper vacuum</description>
                <latching>true</latching>
                <annunciating>true</annunciating>
                <display>
                    <title>Open Vacuum GUI</title>
                    <details>/CLAS12_Share/apps/plcApp/torus_vacuum.opi</details>
                </display>
            </pv>
            <pv name="B_TORUS:VAC:CG8103_RATE">
                <description>CG8103 Rate</description>
                <latching>true</latching>
                <annunciating>true</annunciating>
                <display>
                    <title>Open Vacuum GUI</title>
                    <details>/CLAS12_Share/apps/plcApp/torus_vacuum.opi</details>
                </display>
            </pv>
            <pv name="B_TORUS:VAC:CG8103_AVG1HR">
                <description>CG8103 1hr Avg</description>
                <latching>true</latching>
                <annunciating>true</annunciating>
                <display>
                    <title>Open Vacuum GUI</title>
                    <details>/CLAS12_Share/apps/plcApp/torus_vacuum.opi</details>
                </display>
            </pv>
            <pv name="B_TORUS:VAC:CG8103_AVG10HR">
```

softIOC Management

procServMgr*

- Launcher for procServ
- Uses a simple config file to manage:
  - Server hostname
  - telnet port number
  - IOC enable/disable
  - etc...
- Key actions:
  - start/stop/restart
  - check (start if not running)

softioc_console*

- Uses procServ.conf as “lookup table”
- Issues ssh/telnet commands to softIOC host and port number

ssh –xt <hostname> telnet localhost <port>

Puppet

- Installs cronjobs on softIOC servers, for polling procServMgr

procServ.conf snippet

```
#-------          :--------  :-----  :-------  :----------------  :----------------  :---------------
#iocname          :hostname  :port   :status   :stcmd             :procServ options  :startup options
#-------          :--------  :-----  :-------  :----------------  :----------------  :---------------
#
# cloniocl
#
iocgasSystem      :cloniocl  :20000  :enabled   :./st.cmd         :                  :
iocftcChiller     :cloniocl  :20001  :enabled   :./st.cmd         :                  :
iocftcFlasher     :cloniocl  :20002  :disabled  :./st.cmd         :                  :
iocftcTemps       :cloniocl  :20003  :enabled   :./st.cmd         :                  :
iocprologix       :cloniocl  :20004  :disabled  :./st.cmd         :                  :
```

**Written by: Anthony Cuffe (JLab)*

Host Management

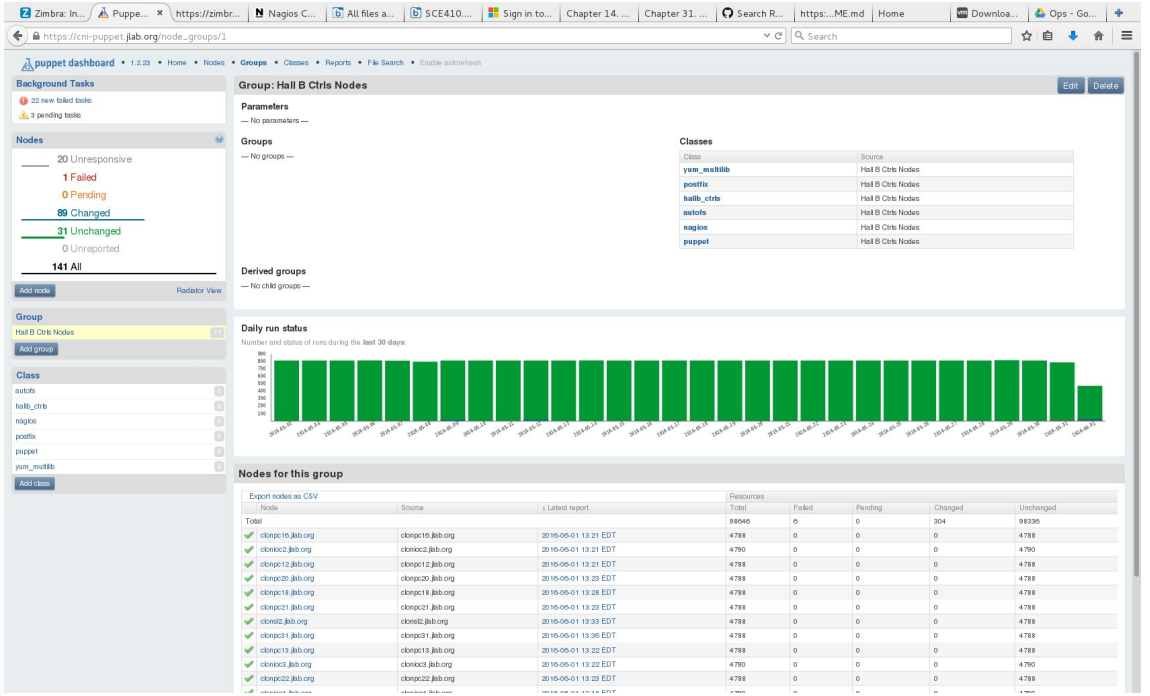
Configuration

- RHEL6 VM
- Puppet
- Puppet Dashboard
- Facter (system profiling)
- All open source

Notes

Host naming scheme makes Puppet config easier, allowing regex matching.

Not used for IOCs. Maybe in the future.



Manages

- Installed packages, yum repos
- NFS mount points, autofs
- Group accounts/passwd
- cron jobs for IOC startups
- Ensures services running. Ex:
  - CA Gateways
  - iocLogServer
- Logrotate

Puppet Server: Sherman White (JLab)

Monitoring

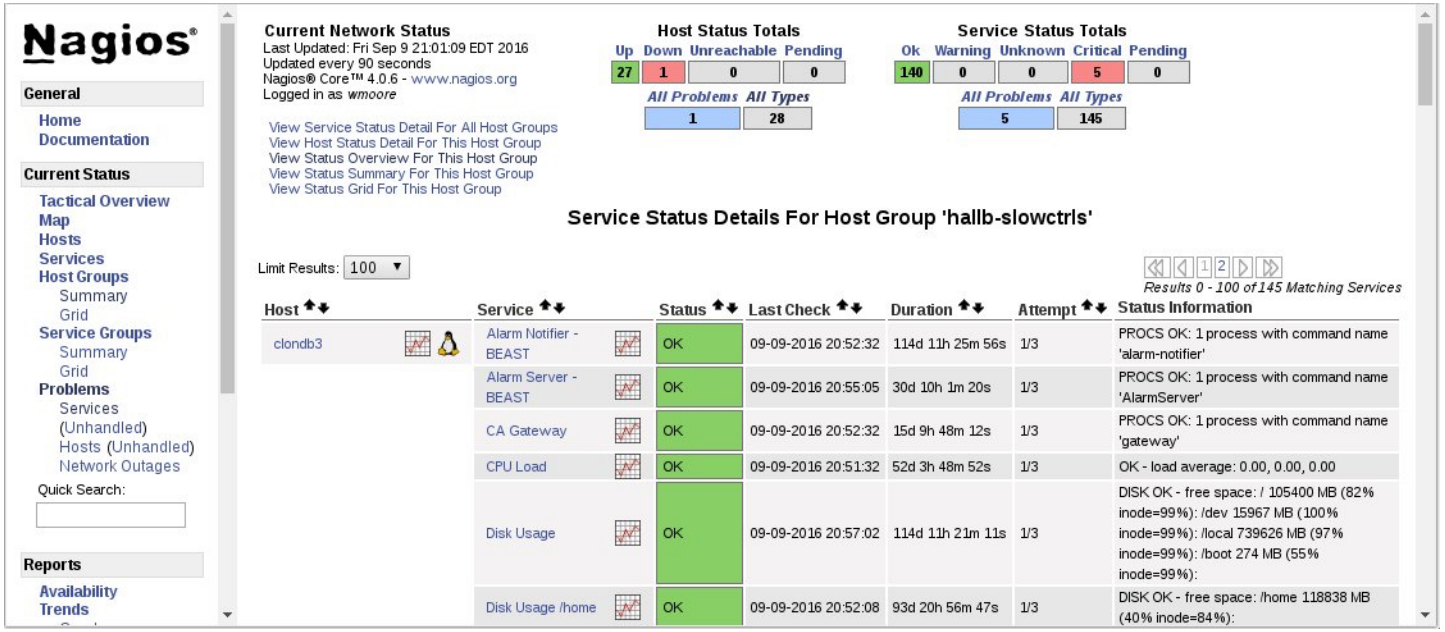
Nagios®

Configuration

- RHEL6 VM
- Nagios 4.0.6
- NRPE 2.15
- Apache
- All open source

Notes

Sends Email and SMS alerts.



Monitors

Resources including:

- CPU load
- Disk space
- Process count

Services including:

- Alarm Server/Notifier
- CA Gateways
- Verify 2-factor logins

Linux VDI

Virtual Desktop Infrastructure

After installing client app:

1. Login to VDI connection server (password)
2. Select a VM-pool from list
3. Login to Linux VM (2-factor)

- Hosted on our existing VM infrastructure
- Cross-platform clients

iOS

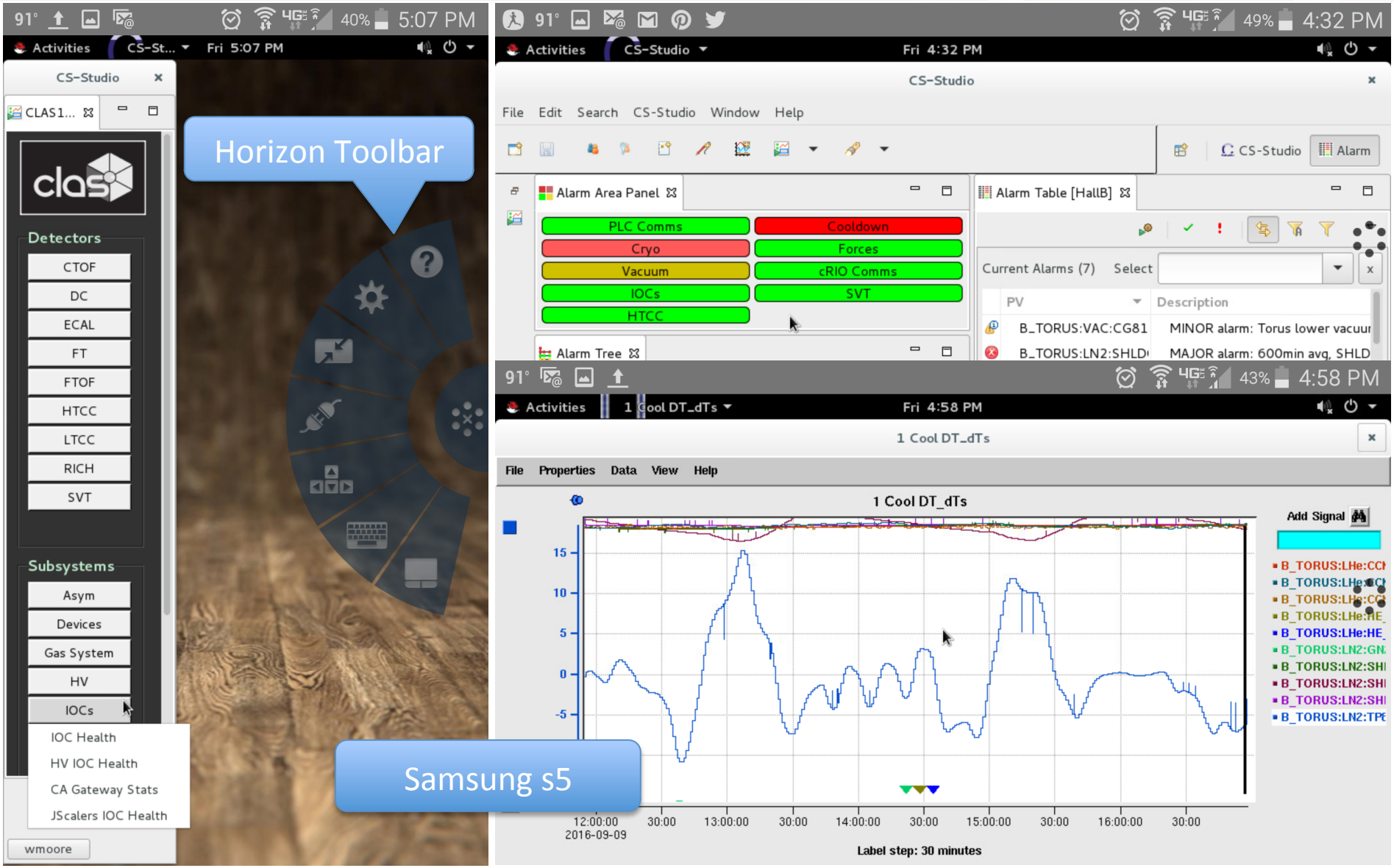
- Reconnect to existing sessions
- Used for remote r/w access
- VMs managed by Puppet, monitored by Nagios

Infrastructure: Myung Bang (JLab)

Linux uses ***VMware Blast*** protocol
Windows uses ***PCoIP***

Linux VDI Mobile

vmware Horizon View

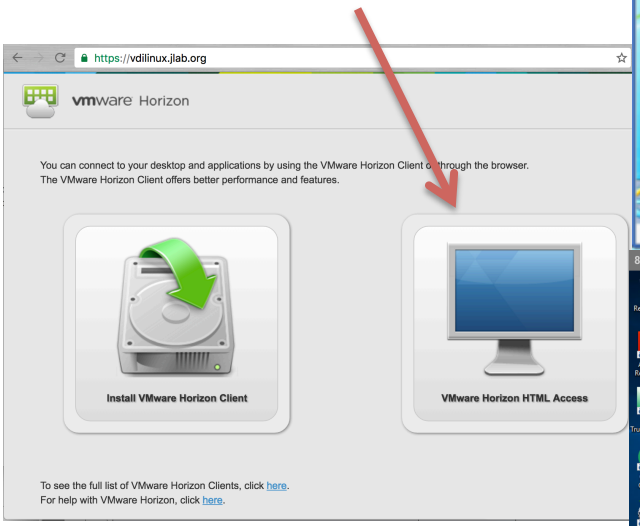


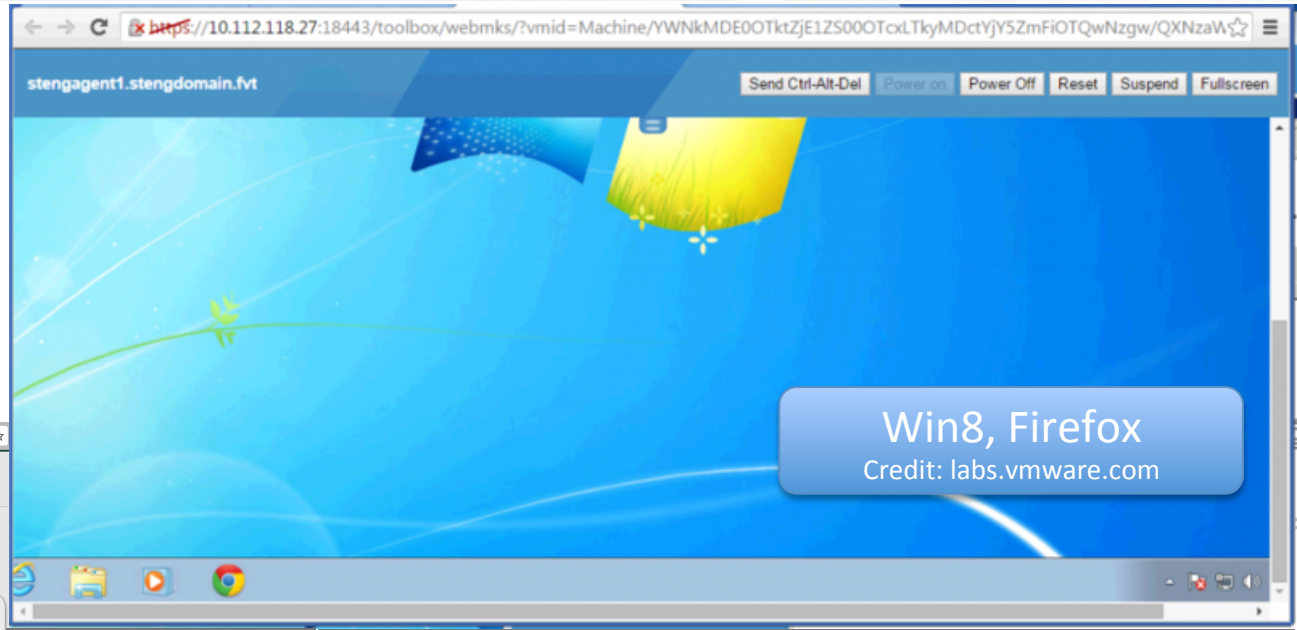
VDI Misc.

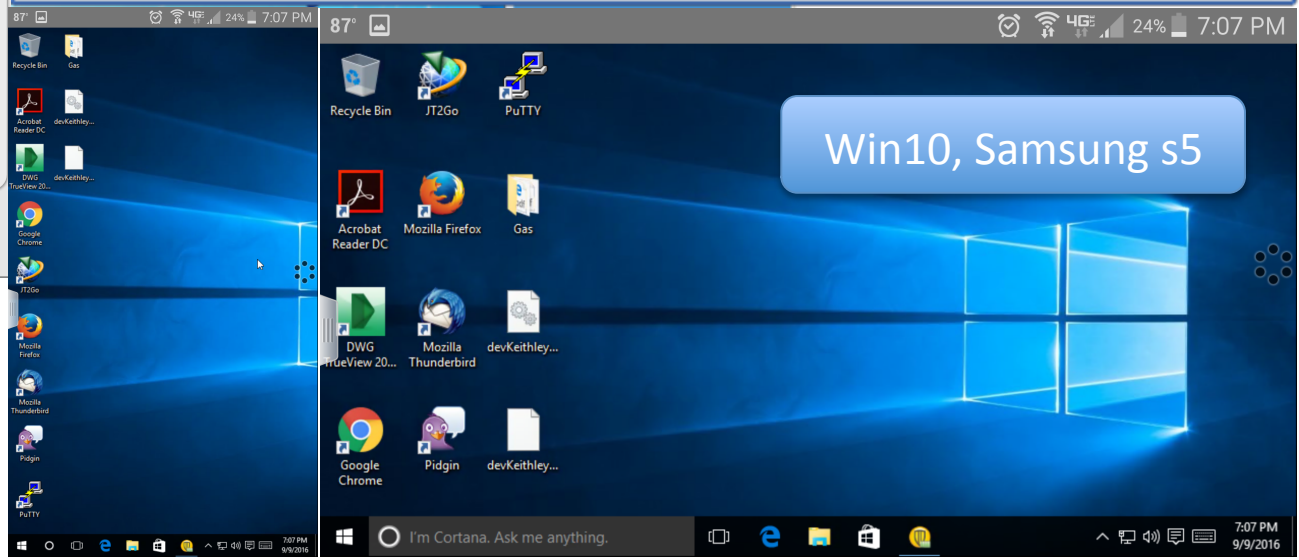
HTML Access

- Connect to Virtual Desktop using only a browser
- No client install required

We haven't configured, but on the TODO list.







Windows

- Better support than Linux *(No zero-clients yet)*
- Used for thin-clients and zero-clients at JLab

Future Plans

- Integrate JLab tools with CS-Studio
  - Logbooks
  - Mya Archiver
- Split alarm configuration
  - Provide separate trees for main detectors
- Improve deployment of new releases
  - CS-Studio
  - BEAST
  - WebOPI and OPI tree to webserver
- Configure VDI HTML access

Questions?

Acknowledgements:

Nathan Baltzell (JLab, Hall B)

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Marty Wise (JLab, CNI)