Using control systems tools for operations and debugging

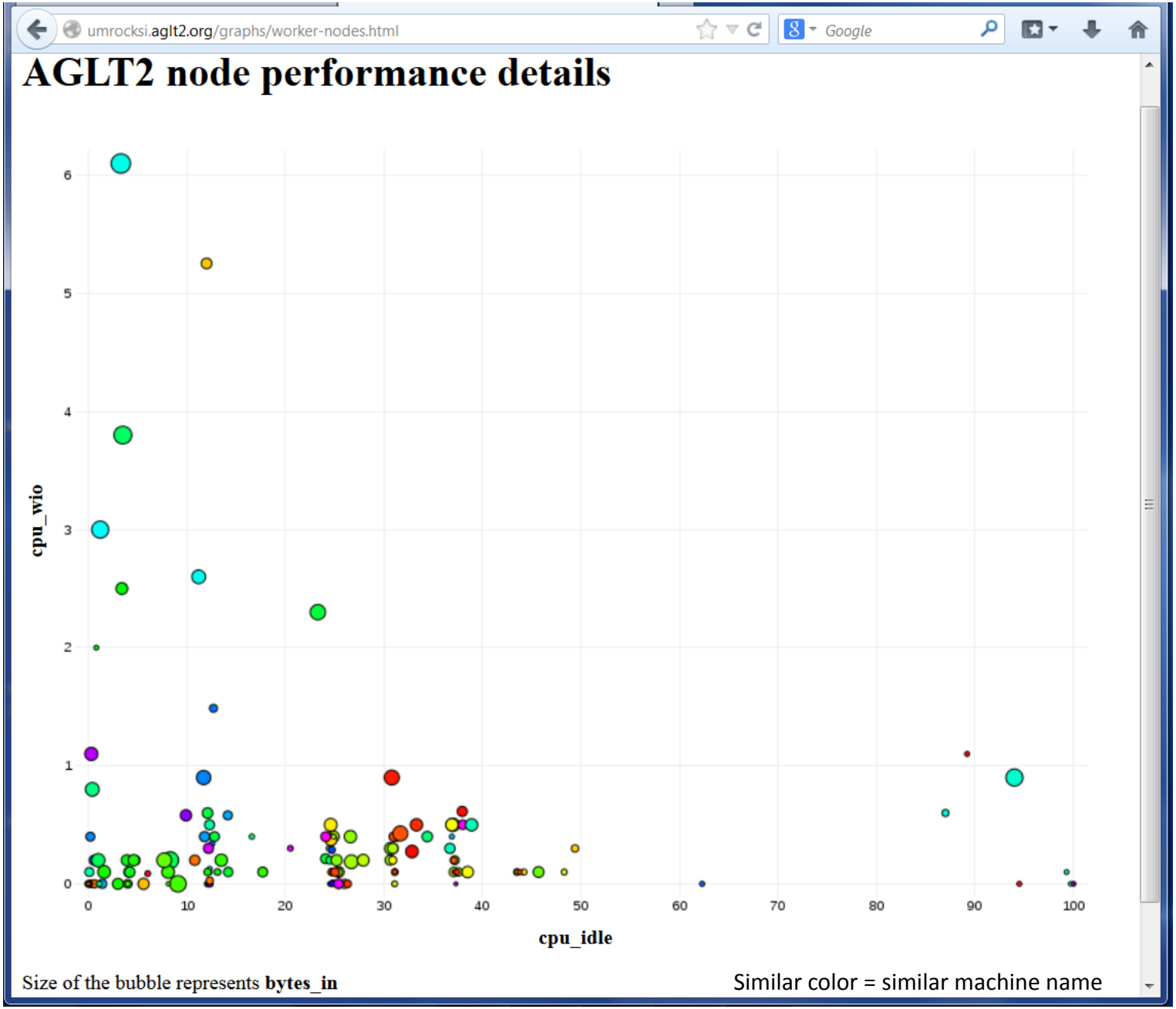
Gabriele Carcassi
University of Michigan – Atlas Tier 2
Brookhaven Nation Lab – NSLS-II controls

About me

- At Brookhaven National Lab since 2002
  - STAR Scheduler, Grid User Management System (GUMS), storage management
- At National Synchrotron Light Source (NSLS-II) since 2008
  - Developing tools for accelerator control systems operations within the EPICS community
- At University of Michigan since 2012
  - Investigating use of control tools for “IT/grid” operation

First attempt

- Take data out of ganglia (rrd) and make correlation/summary plots
- Make it easy to find machines that have “problems”


umrocksi.aglt2.org/graphs/worker-nodes.html
Google
AGLT2 node performance details
cpu_wio
cpu_idle
0
1
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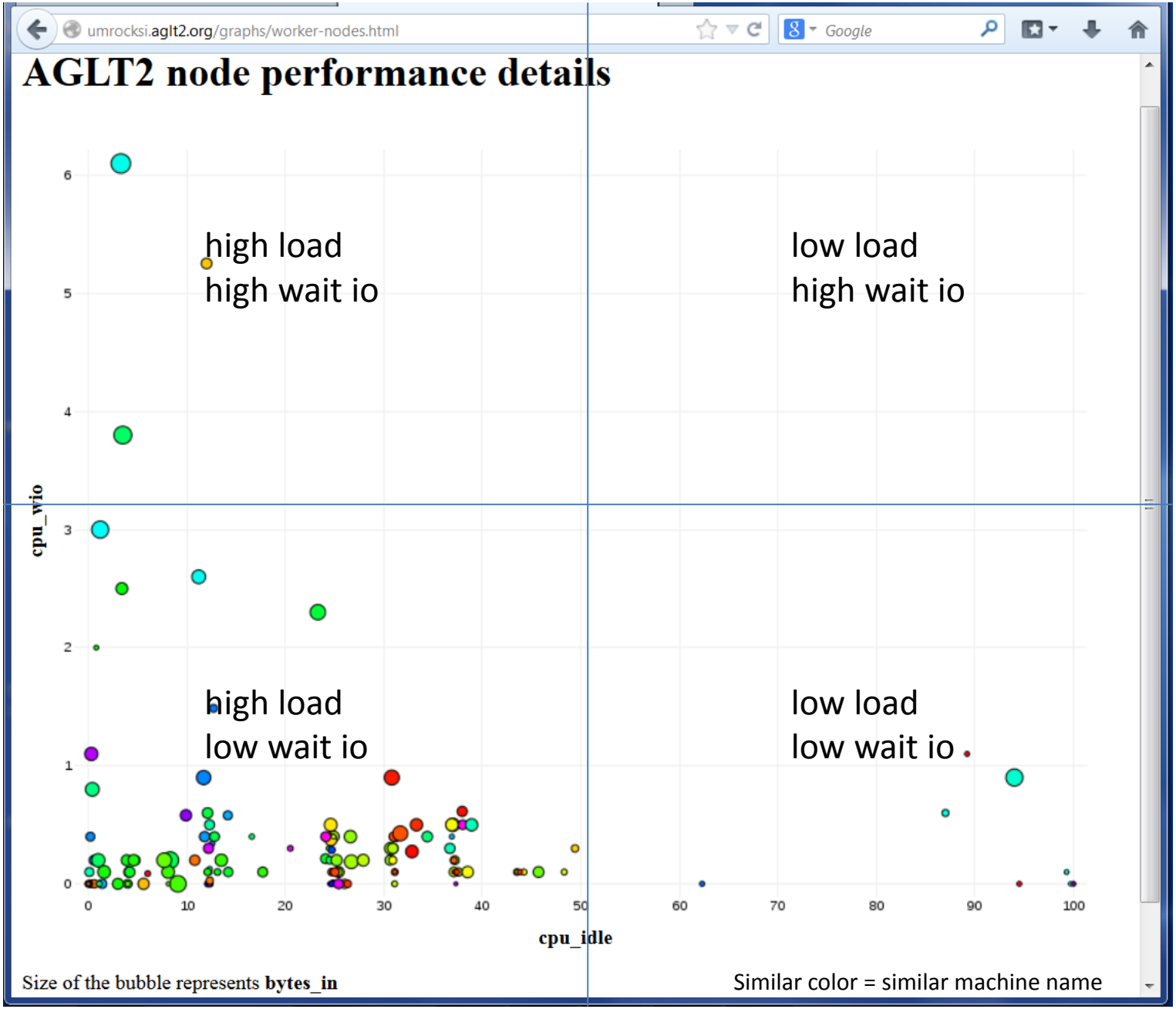
Size of the bubble represents bytes_in
Similar color = similar machine name


umrocksi.aglt2.org/graphs/worker-nodes.html
Google
AGLT2 node performance details
high load
high wait io
low load
high wait io
high load
low wait io
low load
low wait io
cpu_wio
cpu_idle
0
1
2
3
4
5
6
0
10
20
30
40
50
60
70
80
90
100
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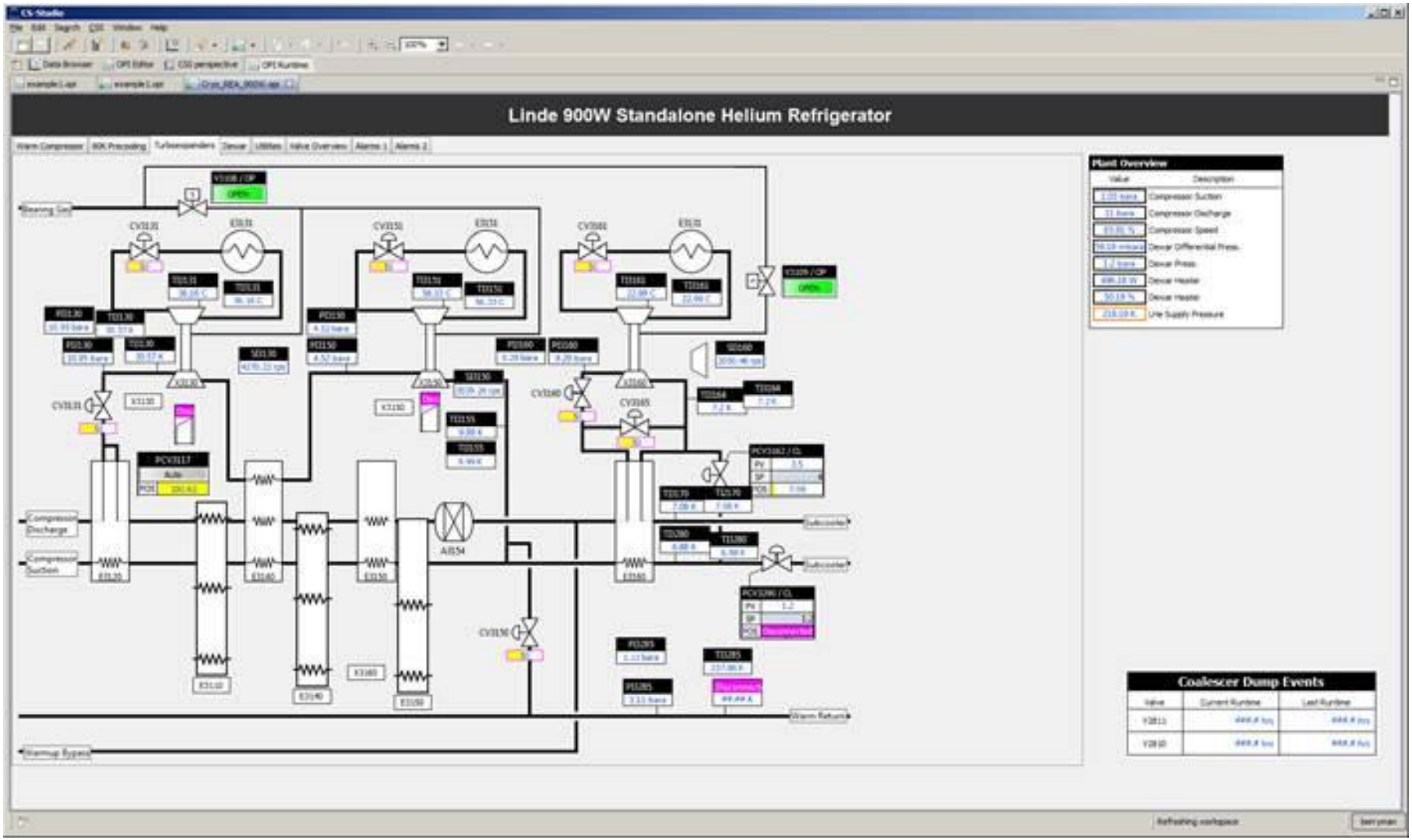
Similar color = similar machine name

Problems with the approach

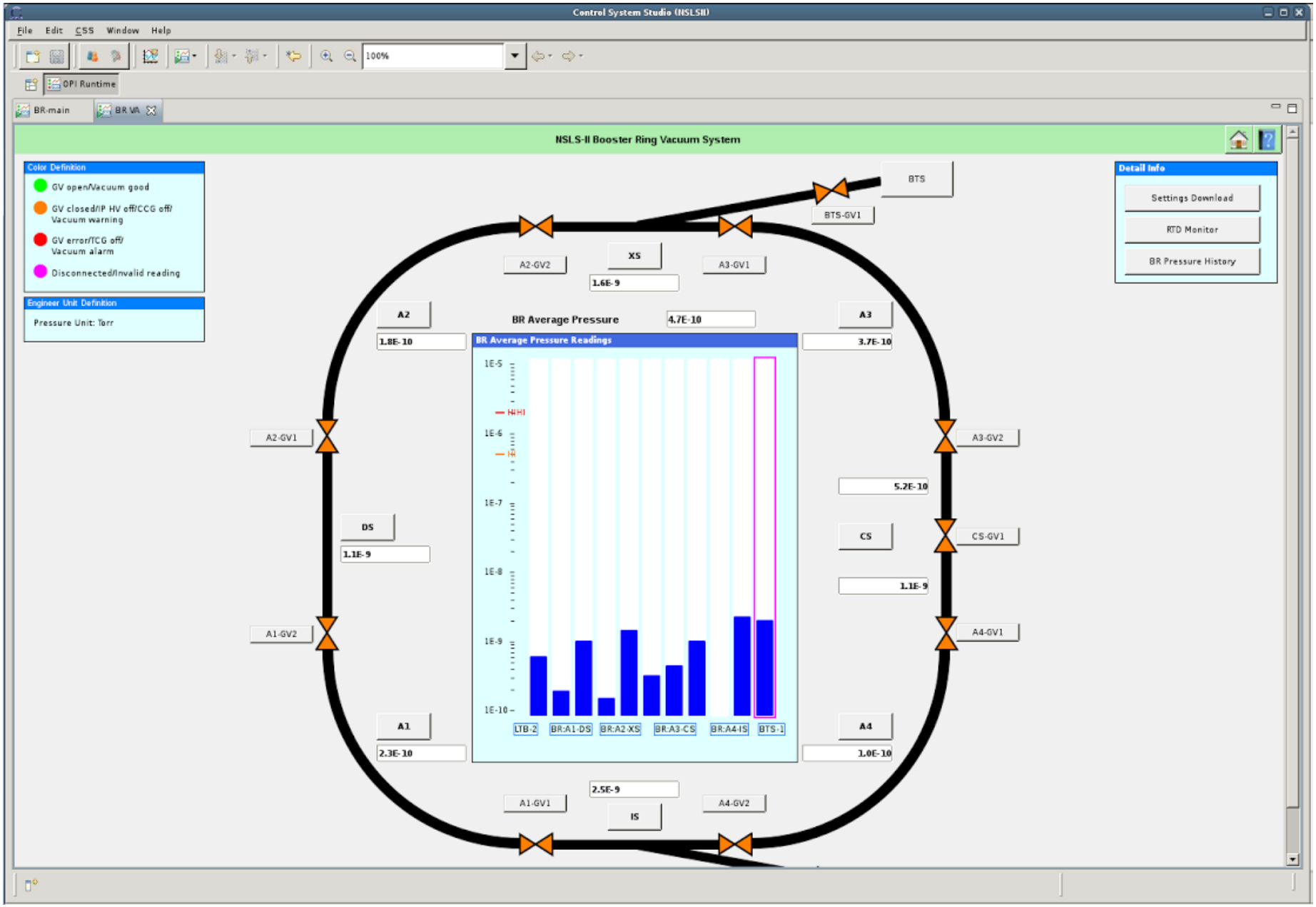
- Not flexible enough
  - Data coming out only from ganglia
  - You need to prepare in advance all types of queries you want
    - Or parameterizations of said queries
  - Each new feature requires another website/page to look at/maintain/tweak

Second attempt

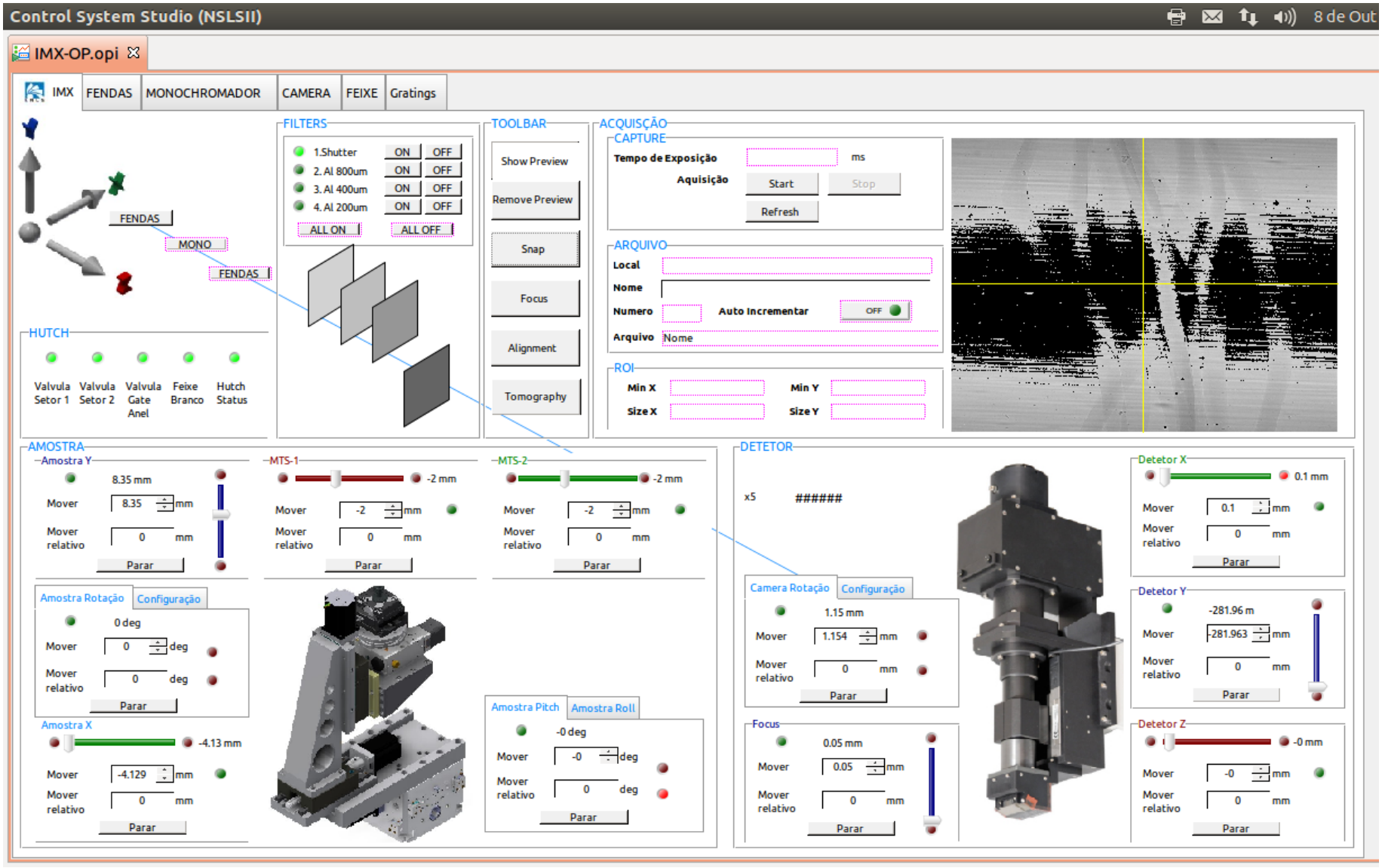
- Based on Control System Studio: aims to provide an integrated environment for control system operation (uses Eclipse RCP)
- Two main functions:
  - Ability to connection to real time data (receive data and send commands)
    - pvmanager (my work)
  - Ability to create and run operator interfaces
- The sources of data will be different, the display will be different, but the core idea is similar
  - Framework is or will be flexible enough



Screenshot from Michigan State: overview of helium refrigerator system



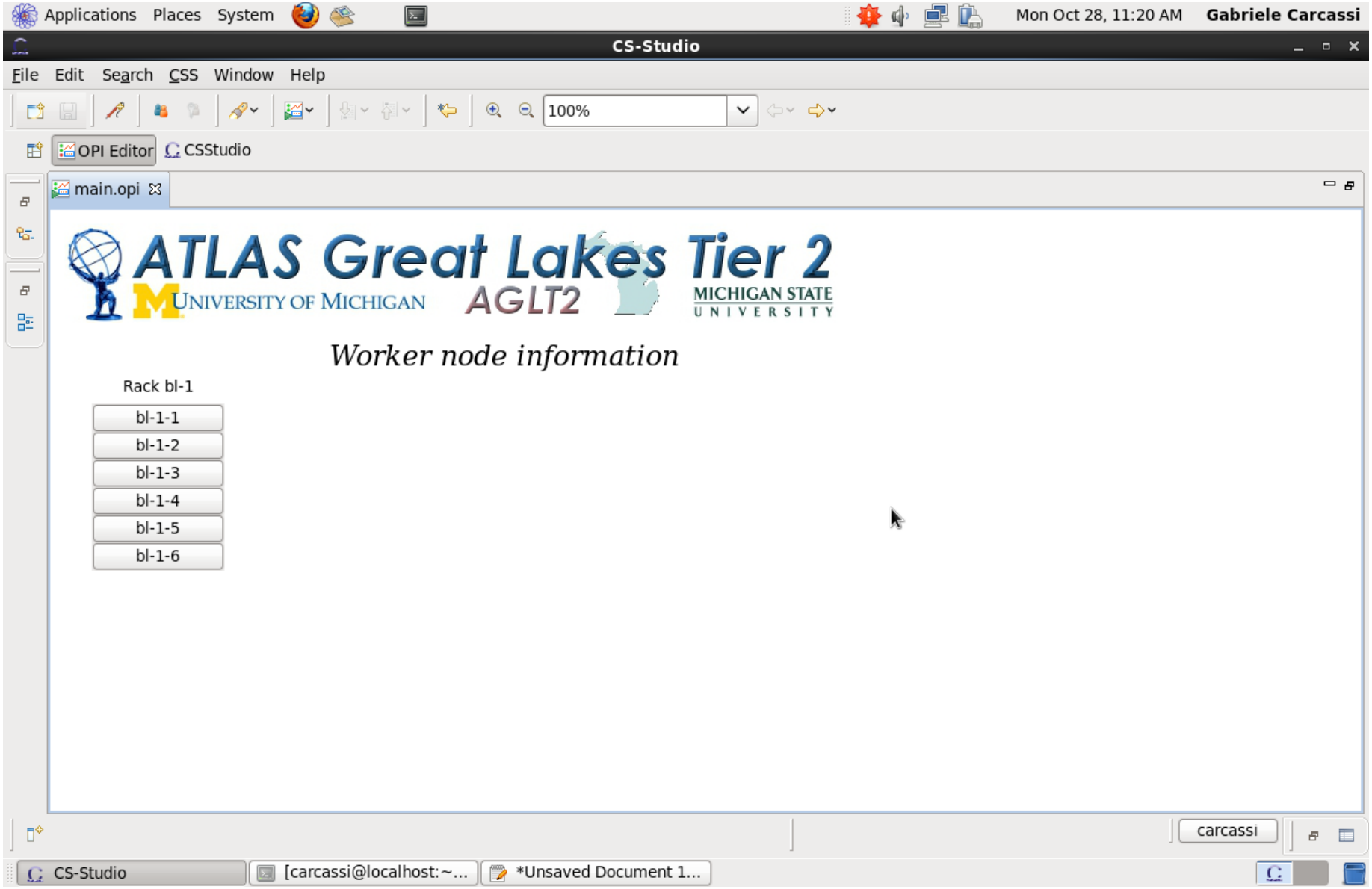
Screenshot from Brookhavem National Lab: vacuum system of NSLS-II booster ring

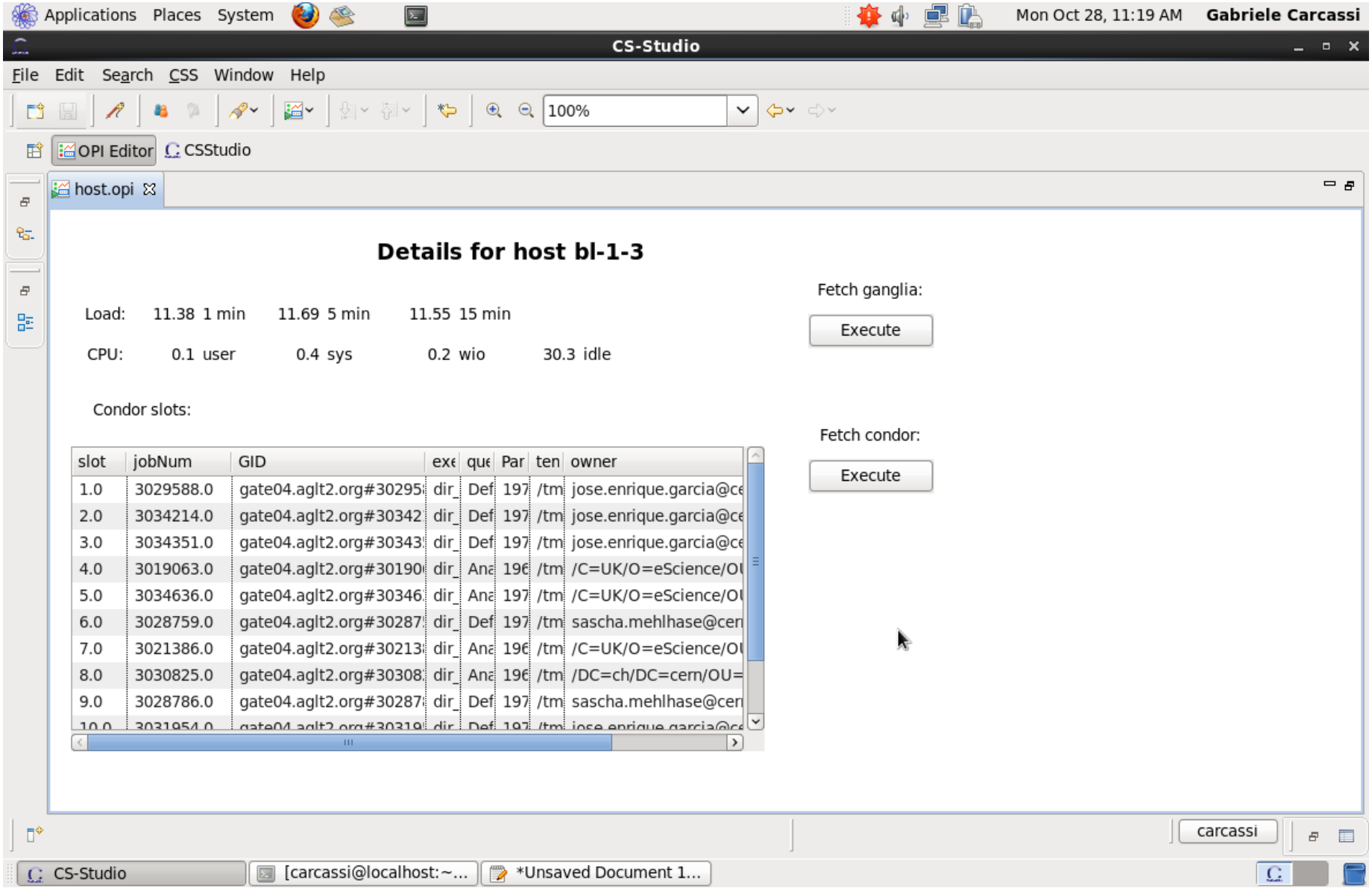


Screenshot from Brazilian Synchrotron Light Source: beamline control

Operator Interfaces

- No programming is required to make screens
  - You drag and drop components
  - You specify what they need to display
  - You can write rules that change colors and other attributes based on values
- At a high level: you create an interface that displays data from multiple sources
- Created a prototype that can get data from both ganglia and condor

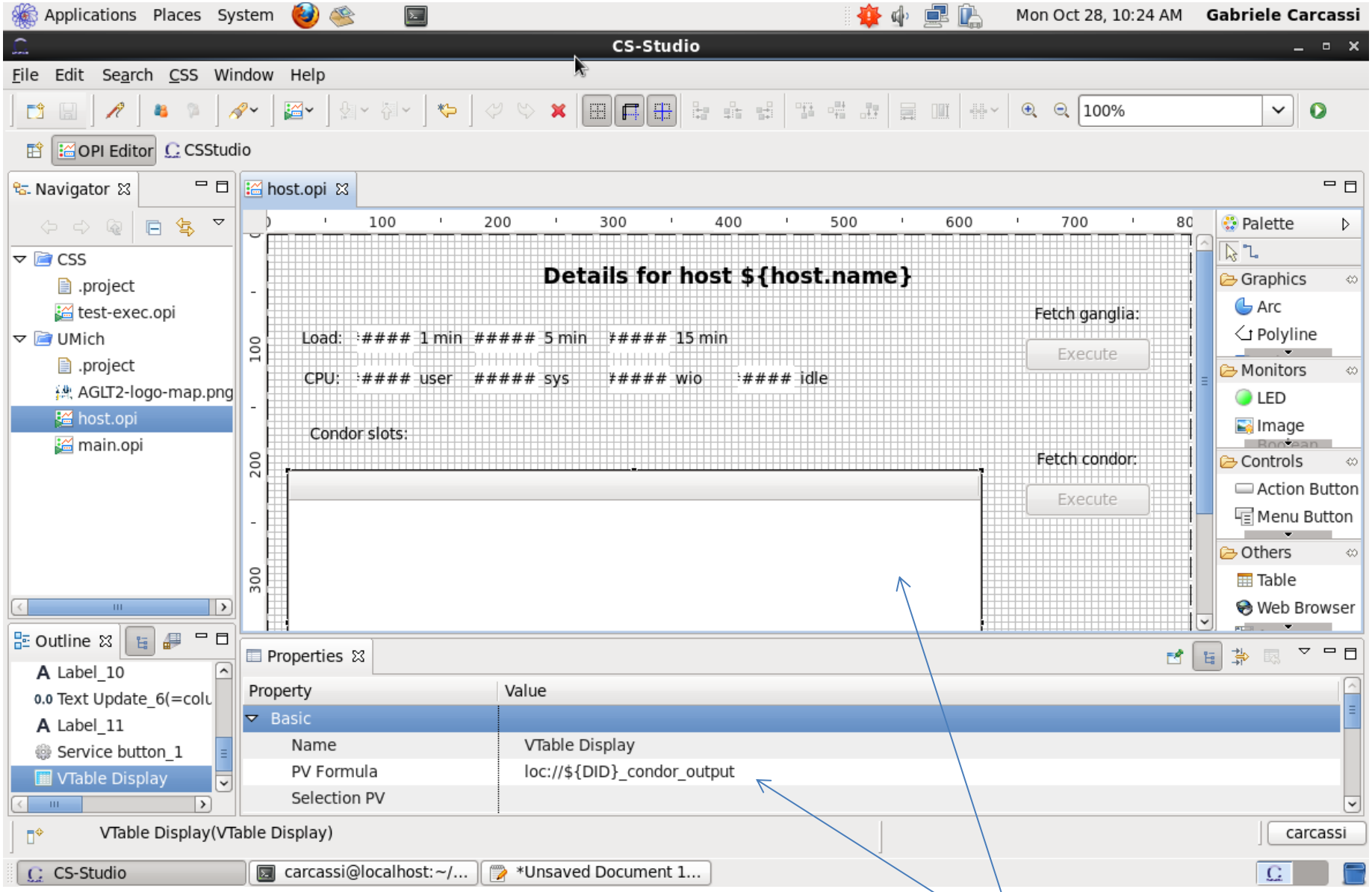

Applications Places System
Mon Oct 28, 11:20 AM Gabriele Carcassi
CS-Studio
File Edit Search CSS Window Help
100%
OPI Editor CSStudio
main.opi
ATLAS Great Lakes Tier 2
UNIVERSITY OF MICHIGAN
AGLT2
MICHIGAN STATE UNIVERSITY
Worker node information
Rack bl-1
bl-1-1
bl-1-2
bl-1-3
bl-1-4
bl-1-5
bl-1-6
carcassi
CS-Studio
[carcassi@localhost:~...
*Unsaved Document 1...


Applications Places System
Mon Oct 28, 11:19 AM Gabriele Carcassi
CS-Studio
File Edit Search CSS Window Help
100%
OPI Editor CSStudio
host.opi
Details for host bl-1-3
Load: 11.38 1 min 11.69 5 min 11.55 15 min
CPU: 0.1 user 0.4 sys 0.2 wio 30.3 idle
Condor slots:
slot jobNum GID exe que Par ten owner
1.0 3029588.0 gate04.aglt2.org#30295 dir_ Def 197 /tm jose.enrique.garcia@ce
2.0 3034214.0 gate04.aglt2.org#30342 dir_ Def 197 /tm jose.enrique.garcia@ce
3.0 3034351.0 gate04.aglt2.org#30343 dir_ Def 197 /tm jose.enrique.garcia@ce
4.0 3019063.0 gate04.aglt2.org#30190 dir_ Ana 196 /tm /C=UK/O=eScience/OU
5.0 3034636.0 gate04.aglt2.org#30346 dir_ Ana 197 /tm /C=UK/O=eScience/OU
6.0 3028759.0 gate04.aglt2.org#30287 dir_ Def 197 /tm sascha.mehlhase@cern
7.0 3021386.0 gate04.aglt2.org#30213 dir_ Ana 196 /tm /C=UK/O=eScience/OU
8.0 3030825.0 gate04.aglt2.org#30308 dir_ Ana 196 /tm /DC=ch/DC=cern/OU=
9.0 3028786.0 gate04.aglt2.org#30287 dir_ Def 197 /tm sascha.mehlhase@cern
Fetch ganglia:
Execute
Fetch condor:
Execute
carcassi
CS-Studio
[carcassi@localhost:~...
*Unsaved Document 1...

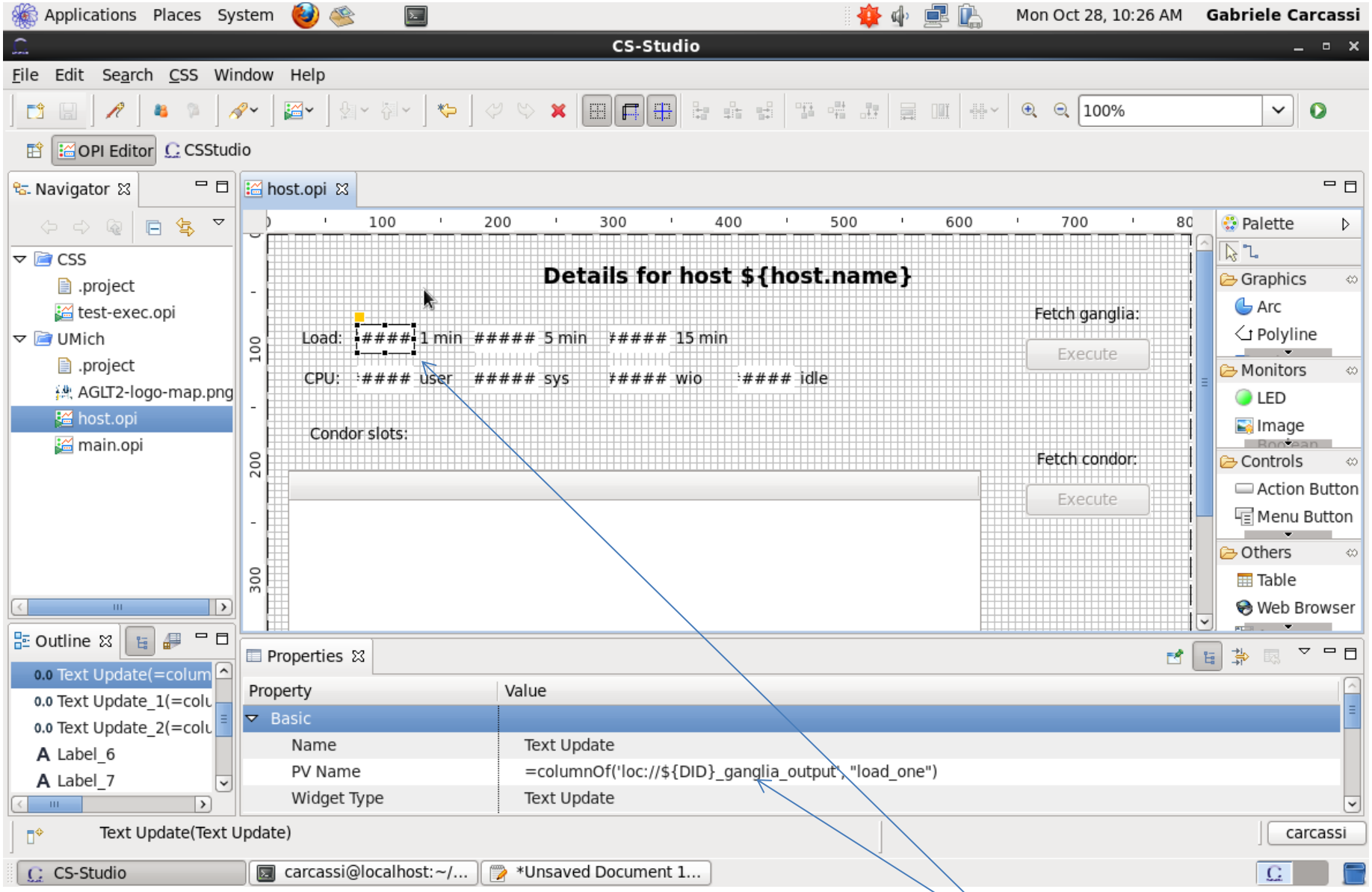
Under the hood

- Data is taken by running external scripts
  - whatever language the want
  - CSV result

```
[carcassi@localhost cs-studio-umich]$ ./ganglia-umich.sh bl-1-1.local
Scientific Linux SL release 5.2 (Boron)
Scientific Linux SL release 5.4 (Boron)
Connection closed by foreign host.
"hostname" "AGLT2_Health" "boottime" "bytes_in" "bytes_out" "cpu_aidle" "cpu_idle"
"cpu_intr" "cpu_nice" "cpu_num" "cpu_sintr" "cpu_speed" "cpu_system" "cpu_user" "cpu_wio"
"disk_free" "disk_total" "load_fifteen" "load_five" "load_one" "machine_type" "mem_buffers"
"mem_cached" "mem_free" "mem_shared" "mem_total" "mtu" "os_name" "os_release"
"part_max_used" "pkts_in" "pkts_out" "proc_run" "proc_total" "ps" "swap_free" "swap_total"
"sys_clock"
"bl-1-1.local" "6" "1377015973" "5448.38" "1309.18" "0.0" "24.8" "0.0" "75.0" "16" "0.0"
"2261" "0.1" "0.1" "0.0" "146.701" "262.963" "12.00" "12.02" "12.02" "x86_64" "99540"
"7678356" "666156" "0" "24724860" "16436" "Linux" "2.6.32-358.11.1.el6.x86_64" "93.2"
"68.32" "6.37" "13" "712" "" "24437752" "24725488" "1382969878"
```



Condor output displayed as a table



Ganglia output extracted from the table and displayed as single fields

Status and future work

- Prototype demonstrated
  - Ability to get data from scripts and databases
  - Integrate into a single place configuration by user
- Future work
  - Implement and refine “plugins” for ganglia, condor, dCache, umich databases, …
    - This is where most of the work lies (you don’t get it for free from the control community)
  - Create operators screens that are interesting to use in production