EDM to CS-Studio conversion at Diamond Light Source

Will Rogers
(thanks to Matthew Furseman for slides)

diamond

Starting point

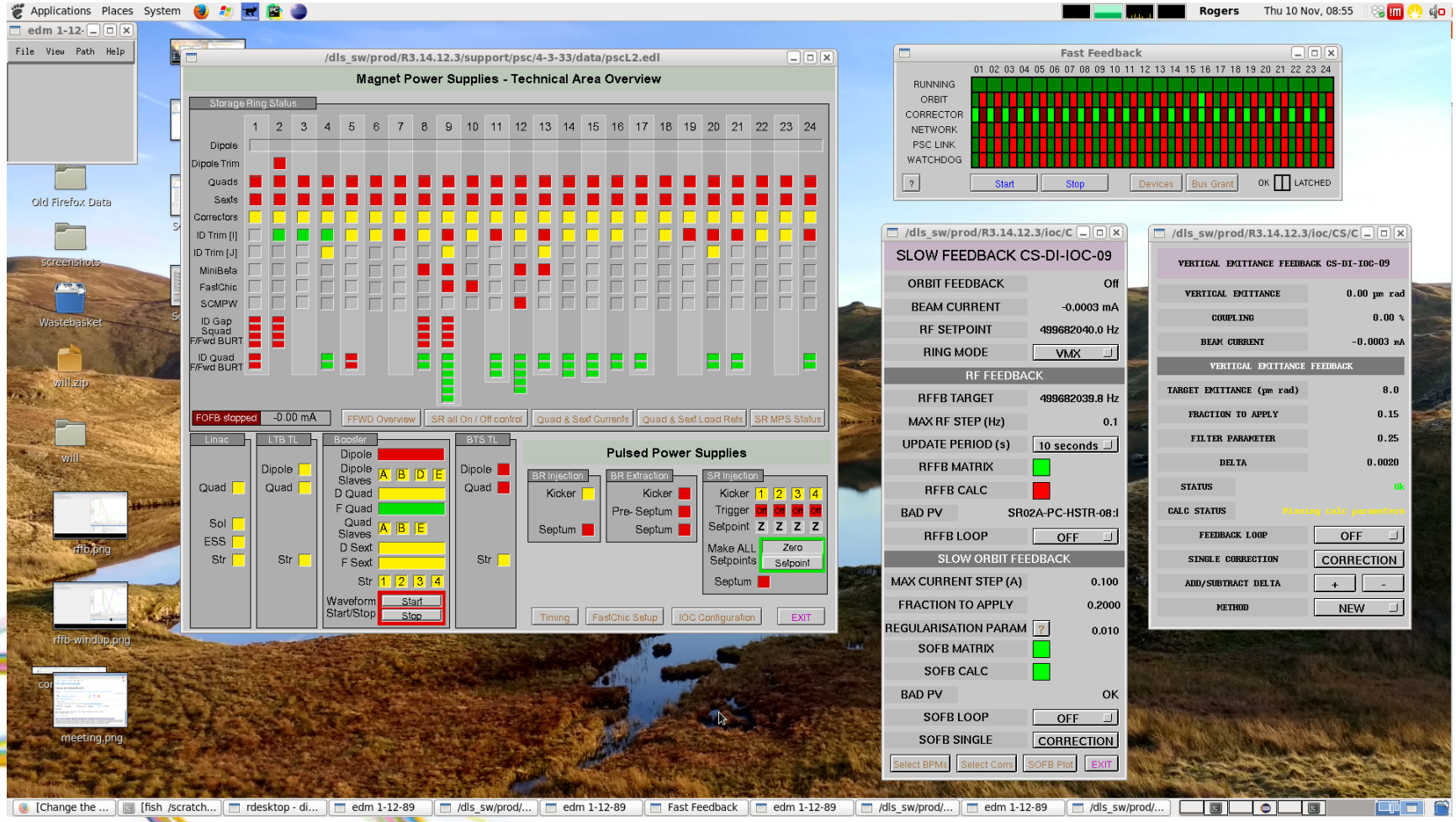
- We’ve used EDM since Diamond started
- It is stable and we have been happy with its performance
- It is a bit quirky
- We have multiple thousand screens in use

diamond

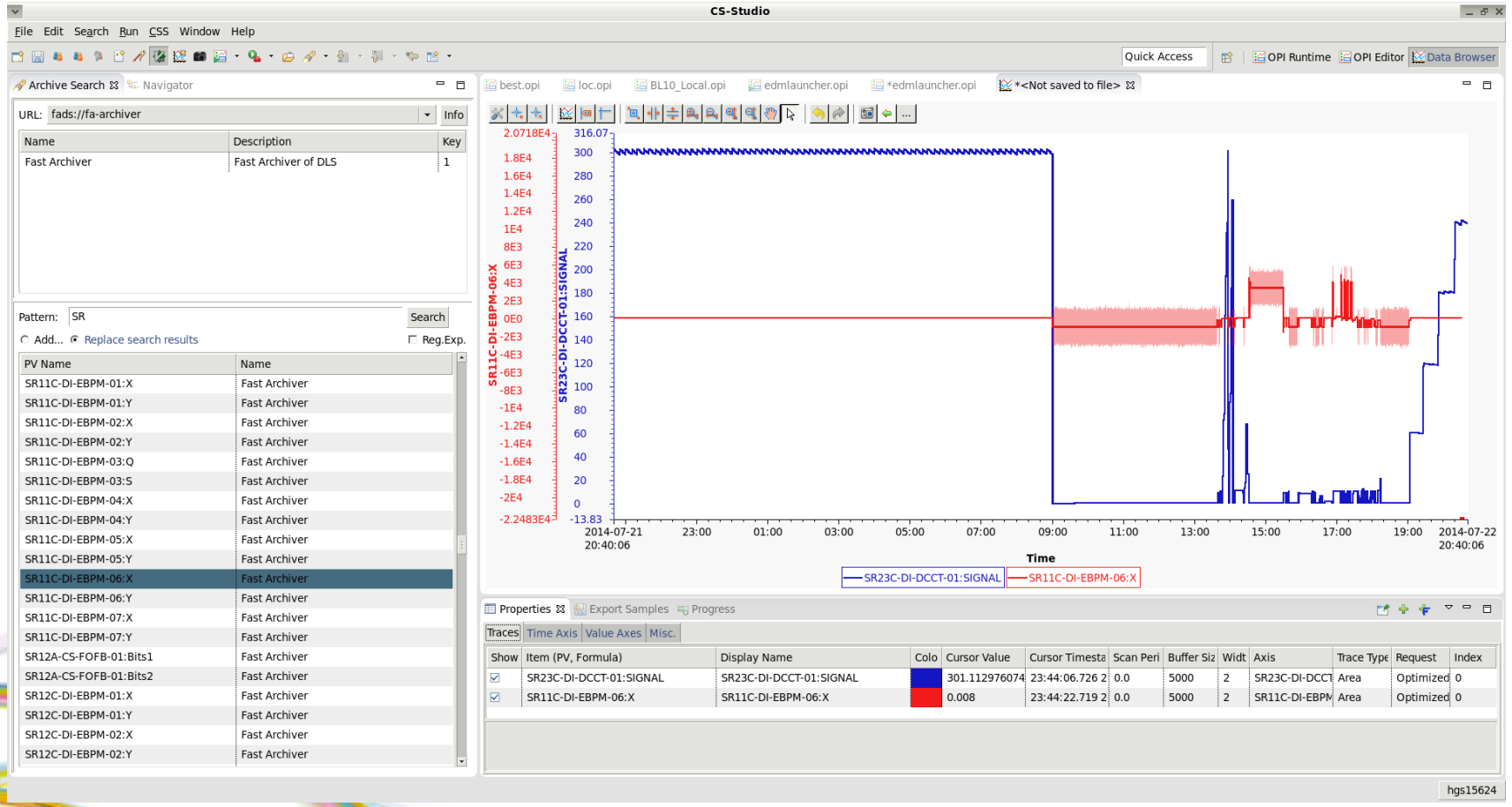
Motivation for moving from EDM to CS-Studio

- EDM is nearing end of life
- EDM's libraries are being phased out.
- EDM is supported by one person, CS-Studio has community support due to use at many sites.
- We could benefit from the rest of the infrastructure that CS-Studio provides, such as BEAST on beamlines and V4 compatibility.
- Potential to integrate into DAWN and GDA; Diamond's data analysis and data acquisition software is also built on Eclipse RCP.

EDM


Applications Places System
Rogers Thu 10 Nov, 08:55
edm 1-12-
File View Path Help
Old Firefox Data
screenshots
Wastebasket
will.zip
will
rffb.png
rffb-windup.png
meeting.png
/dls_sw/prod/R3.14.12.3/support/psc/4-3-33/data/pscL2.edl
Magnet Power Supplies - Technical Area Overview
Storage Ring Status
Dipole
Dipole Trim
Quads
Sexts
Correctors
ID Trim [I]
ID Trim [J]
MiniBeta
FastChic
SCMPW
ID Gap Squad F/Fwd BURT
ID Quad F/Fwd BURT
FOFB stopped -0.00 mA
FFWD Overview
SR all On / Off control
Quad & Sext Currents
Quad & Sext Load Refs
SR MPS Status
Linac
LTB TL
Booster
BTS TL
Pulsed Power Supplies
BR Injection
BR Extraction
SR Injection
Timing
FastChic Setup
IOC Configuration
EXIT
Fast Feedback
RUNNING
ORBIT
CORRECTOR
NETWORK
PSC LINK
WATCHDOG
Start
Stop
Devices
Bus Grant
LATCHED
/dls_sw/prod/R3.14.12.3/ioc/C
SLOW FEEDBACK CS-DI-IOC-09
ORBIT FEEDBACK Off
BEAM CURRENT -0.0003 mA
RF SETPOINT 499682040.0 Hz
RING MODE VMX
RF FEEDBACK
RFFB TARGET 499682039.8 Hz
MAX RF STEP (Hz) 0.1
UPDATE PERIOD (s) 10 seconds
RFFB MATRIX
RFFB CALC
BAD PV SR02A-PC-HSTR-08:I
RFFB LOOP OFF
SLOW ORBIT FEEDBACK
MAX CURRENT STEP (A) 0.100
FRACTION TO APPLY 0.2000
REGULARISATION PARAM 0.010
SOFB MATRIX
SOFB CALC
BAD PV OK
SOFB LOOP OFF
SOFB SINGLE CORRECTION
Select BPMs
Select Corrs
SOFB Plot
EXIT
/dls_sw/prod/R3.14.12.3/ioc/CS/C
VERTICAL EMITTANCE FEEDBACK CS-DI-IOC-09
VERTICAL EMITTANCE 0.00 pm rad
COUPLING 0.00 %
BEAM CURRENT -0.0003 mA
VERTICAL EMITTANCE FEEDBACK
TARGET EMITTANCE (pm rad) 8.0
FRACTION TO APPLY 0.15
FILTER PARAMETER 0.25
DELTA 0.0020
STATUS Ok
CALC STATUS Missing calc parameters
FEEDBACK LOOP OFF
SINGLE CORRECTION CORRECTION
ADD/SUBTRACT DELTA + -
METHOD NEW
[Change the ...
[fish /scratch...
rdesktop - di...
edm 1-12-89
/dls_sw/prod/...
edm 1-12-89
Fast Feedback
edm 1-12-89
/dls_sw/prod/...
edm 1-12-89
/dls_sw/prod/...

CS-Studio


CS-Studio
File Edit Search Run CSS Window Help
Quick Access
OPI Runtime
OPI Editor
Data Browser
Archive Search
Navigator
URL: fads://fa-archiver
Info
Name
Description
Key
Fast Archiver
Fast Archiver of DLS
1
Pattern: SR
Search
Add...
Replace search results
Reg.Exp.
PV Name
Name
SR11C-DI-EBPM-01:X
SR11C-DI-EBPM-01:Y
SR11C-DI-EBPM-02:X
SR11C-DI-EBPM-02:Y
SR11C-DI-EBPM-03:Q
SR11C-DI-EBPM-03:S
SR11C-DI-EBPM-04:X
SR11C-DI-EBPM-04:Y
SR11C-DI-EBPM-05:X
SR11C-DI-EBPM-05:Y
SR11C-DI-EBPM-06:X
SR11C-DI-EBPM-06:Y
SR11C-DI-EBPM-07:X
SR11C-DI-EBPM-07:Y
SR12A-CS-FOFB-01:Bits1
SR12A-CS-FOFB-01:Bits2
SR12C-DI-EBPM-01:X
SR12C-DI-EBPM-01:Y
SR12C-DI-EBPM-02:X
SR12C-DI-EBPM-02:Y
Fast Archiver
best.opi
loc.opi
BL10_Local.opi
edmlauncher.opi
*edmlauncher.opi
*<Not saved to file>
SR11C-DI-EBPM-06:X
SR23C-DI-DCCT-01:SIGNAL
Time
2014-07-21 20:40:06
2014-07-22 20:40:06
Properties
Export Samples
Progress
Traces
Time Axis
Value Axes
Misc.
Show
Item (PV, Formula)
Display Name
Colo
Cursor Value
Cursor Timesta
Scan Peri
Buffer Siz
Widt
Axis
Trace Type
Request
Index
SR23C-DI-DCCT-01:SIGNAL
301.112976074
23:44:06.726 2
0.0
5000
2
Area
Optimized
0
SR11C-DI-EBPM-06:X
0.008
23:44:22.719 2
0.0
5000
2
Area
Optimized
0
hgs15624

Aside: philosophy of conversion

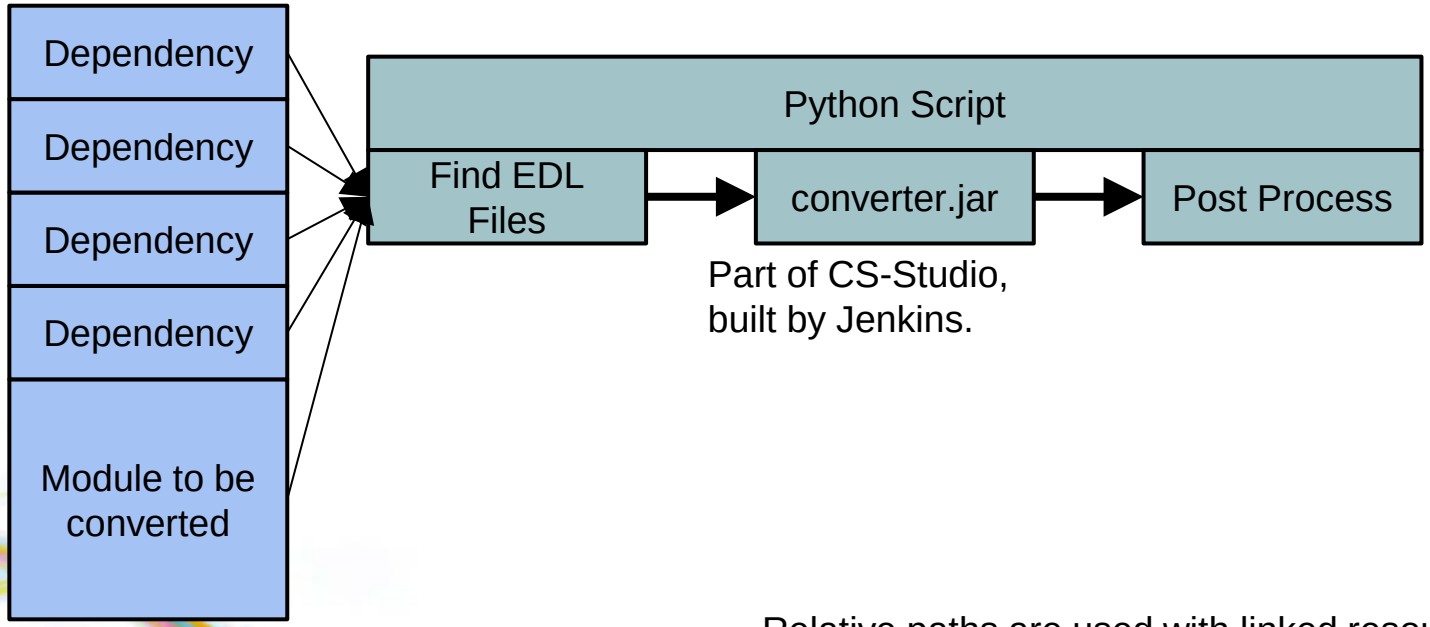
Guiding principle:

Provide the operators with a familiar environment

1. One EDM screen to one CS-Studio screen
   - A converter was already available
2. Standalone windows
   - Operators can keep their layouts
3. Keep up-to-date with the collaboration
   - This takes time and effort
4. Never try to format anything in Powerpoint

Overview of conversion process

Checkout module to be converted.
Script checks configure/* for dependencies and also checks out dependent module tree.



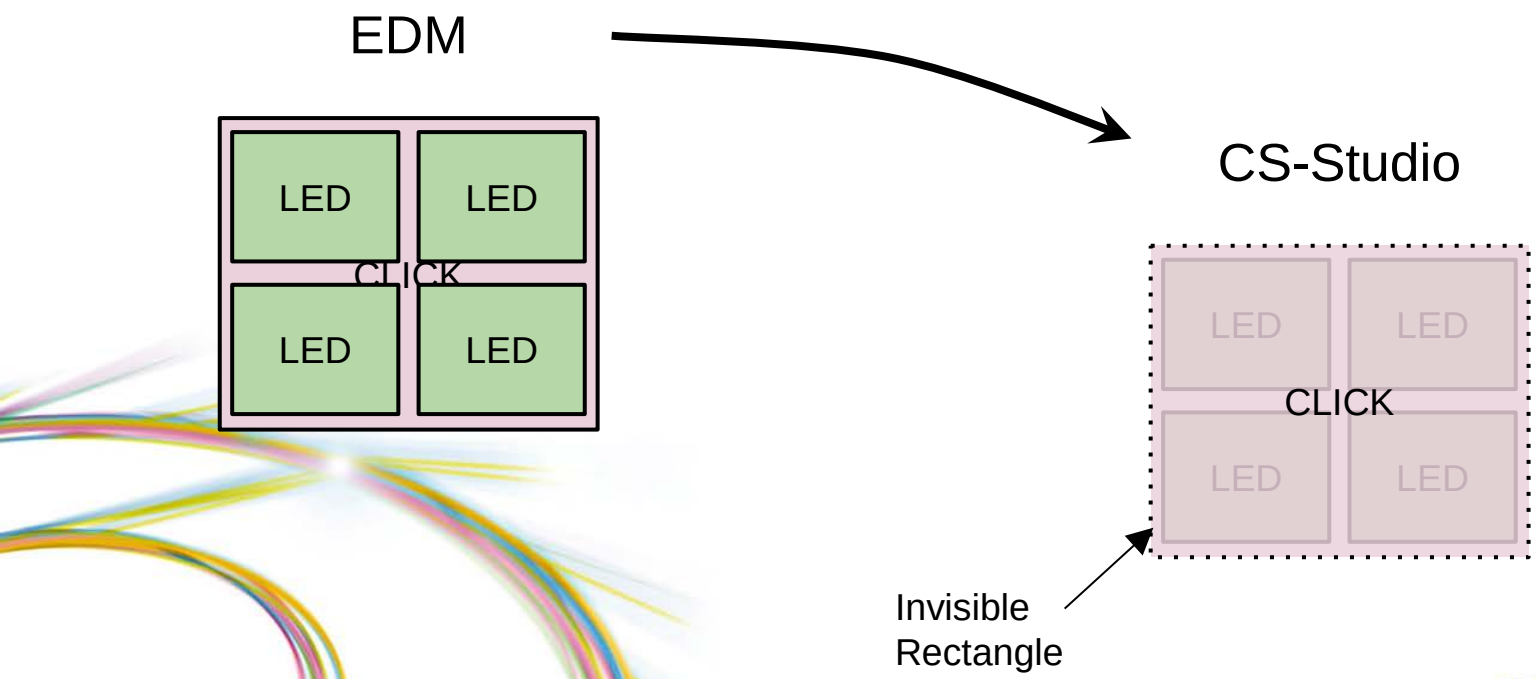
Relative paths are used with linked resources to take care of versioning and editing out of the read only production file system.

https://github.com/dls-controls/css-converter-python

diamond

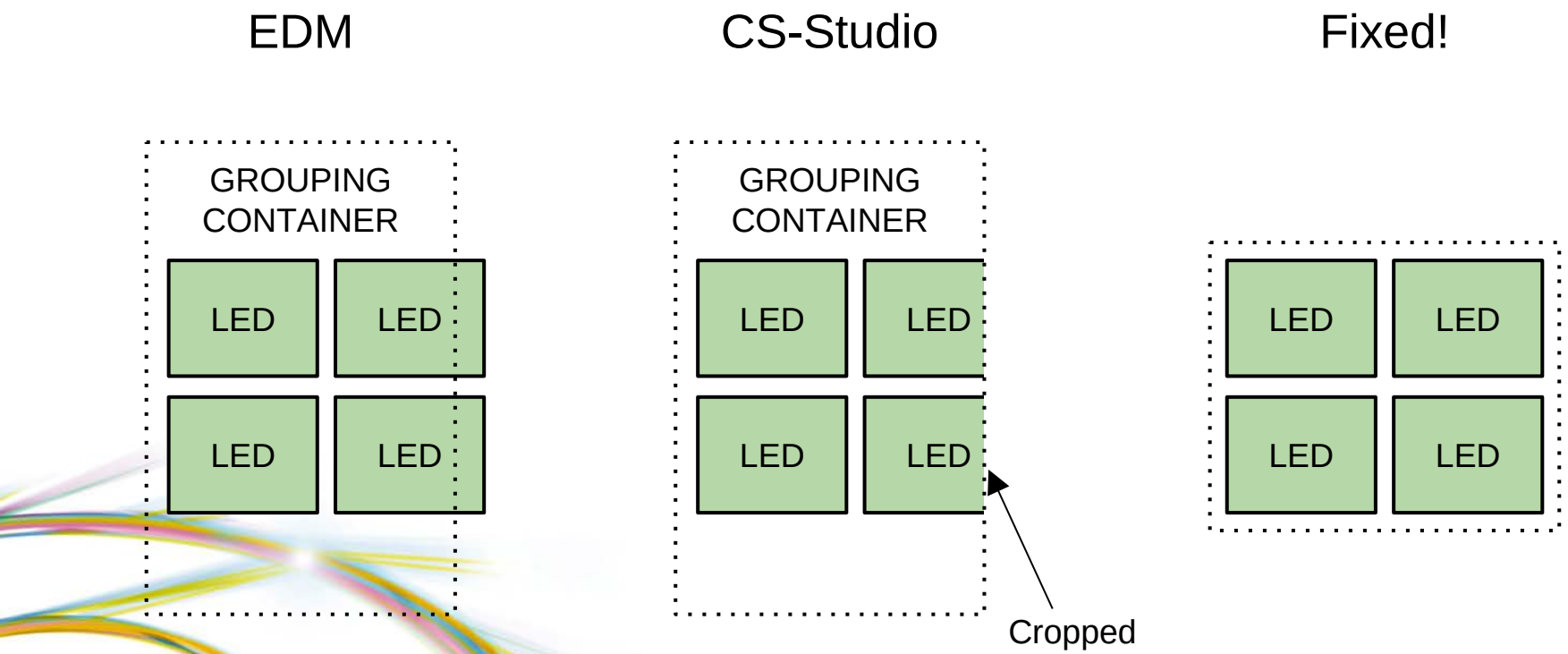
Post processing: Click ordering

Widgets must be on the top of the stack to be clickable in CS-Studio but not in EDM.
Recreate clicks on the top attached to an invisible rectangle.



Post processing: Grouping containers

Extend grouping container boundaries to include all widgets.



Post processing

- The above clicks and groups
- Convert EDL symbol files for DLS symbol widget.
- Swap some fonts and sizes to improve legibility.
- Tweak colours to keep antialiased fonts legible.

Must ‘infer’ what the designer wants
Results in some manual corrections

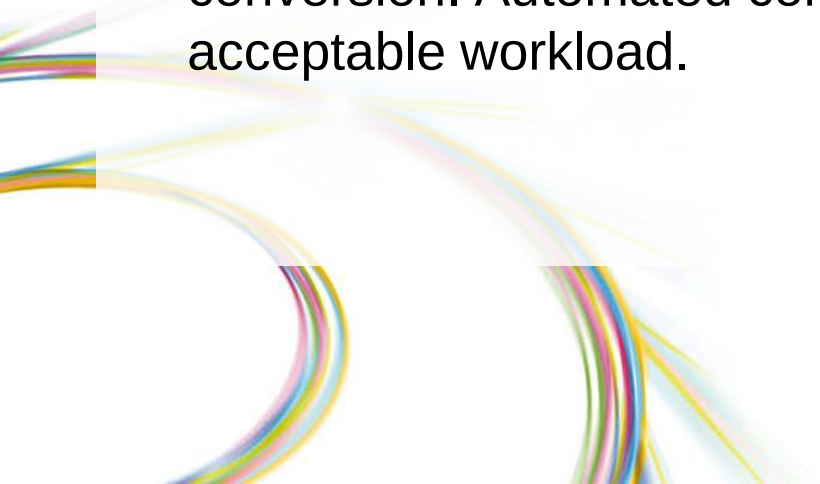
Many small issues we have overcome

- Can’t create local Enum PVs
- Escaping quotes in external command line calls
- Unsigned data in intensity graph
- Missing grid lines in XY-Graph
- Keeping specific OPI files bound to a view when changing perspective and restarting
- Many many more...

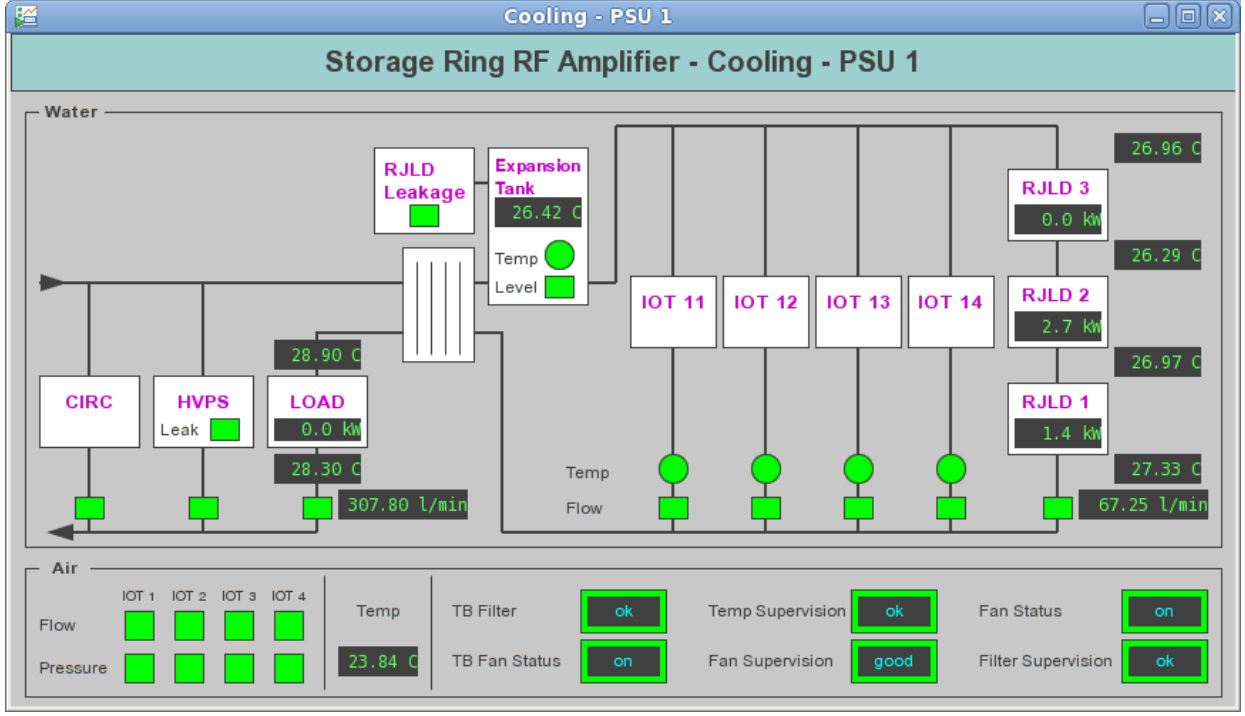
Some more small issues yet to be overcome

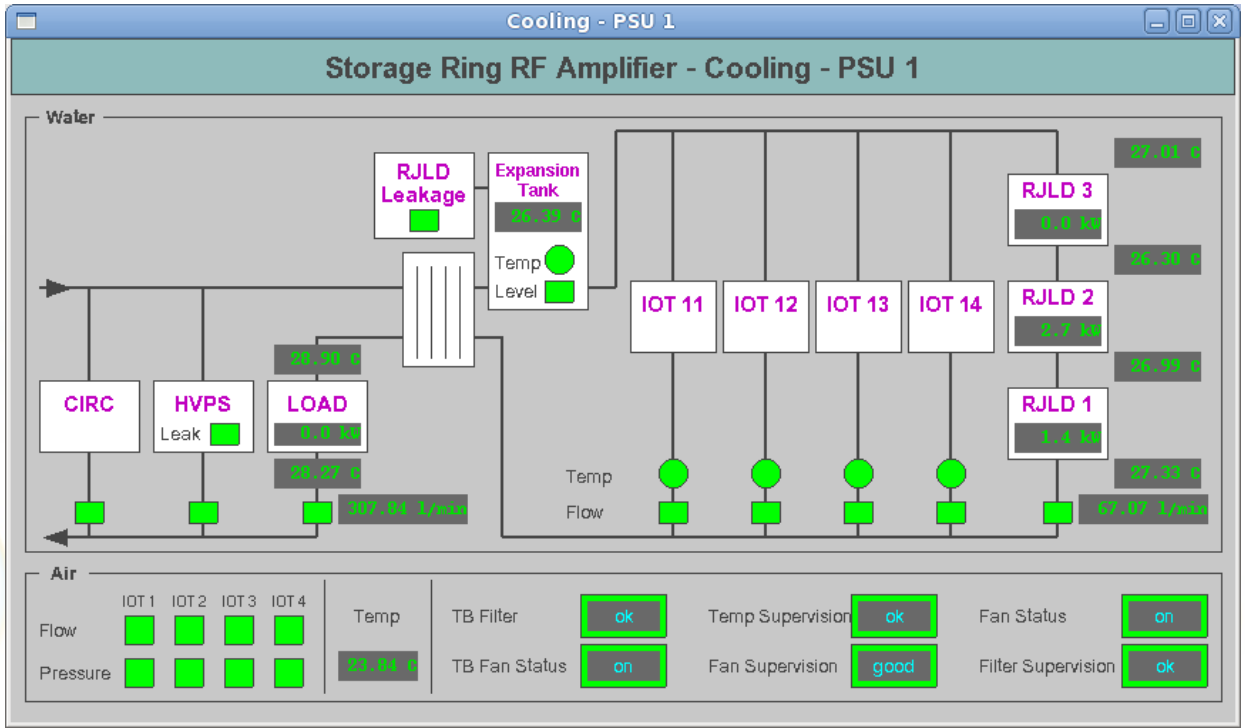
- Char arrays are shown as integers in text updates, not ASCII text.
- Small (~1px) sized details can be lost by slight changes in widget and border dimensions.
- Font and colour tweaks have unexpected results when screens don’t conform to design guidelines.
- Graph missing points, because it has 250,000 of them!

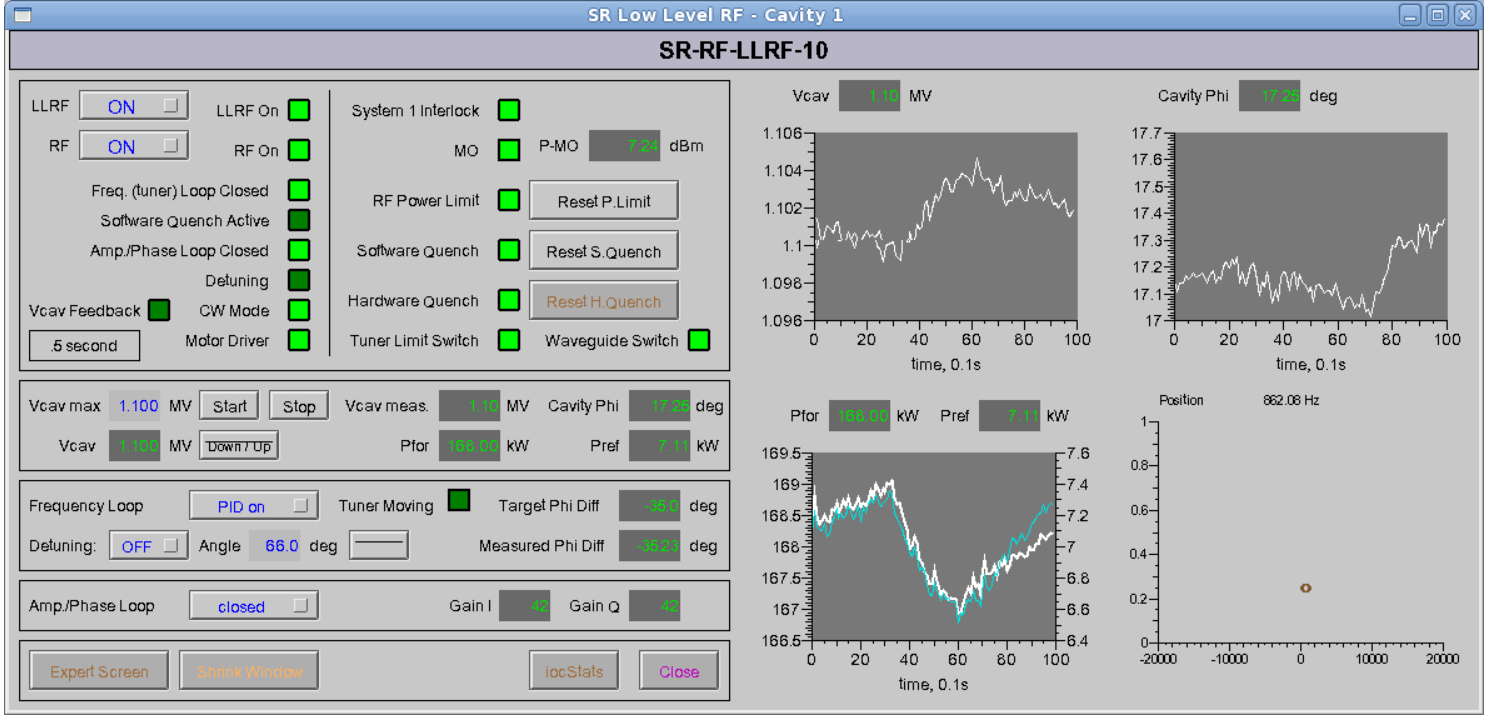
These types of issue can normally be patched manually after conversion. Automated conversion needs to reduce this to an acceptable workload.

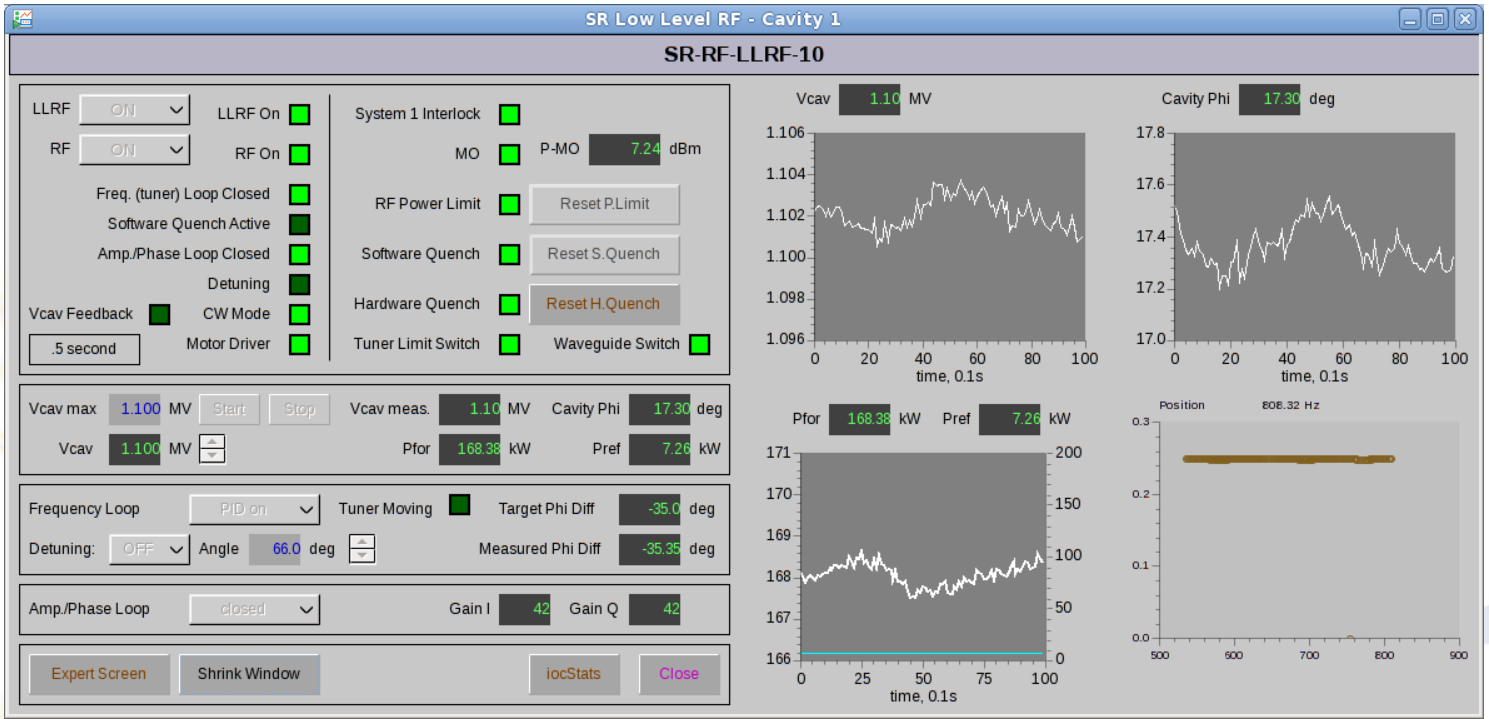


diamond


Cooling - PSU 1
Storage Ring RF Amplifier - Cooling - PSU 1
Water
RJLD Leakage
Expansion Tank
26.42 C
Temp
Level
28.90 C
CIRC
HVPS
Leak
LOAD
0.0 kW
28.30 C
307.80 l/min
IOT 11
IOT 12
IOT 13
IOT 14
Temp
Flow
26.96 C
RJLD 3
0.0 kW
26.29 C
RJLD 2
2.7 kW
26.97 C
RJLD 1
1.4 kW
27.33 C
67.25 l/min
Air
IOT 1
IOT 2
IOT 3
IOT 4
Flow
Pressure
Temp
23.84 C
TB Filter
ok
TB Fan Status
on
Temp Supervision
ok
Fan Supervision
good
Fan Status
on
Filter Supervision
ok


Cooling - PSU 1
Storage Ring RF Amplifier - Cooling - PSU 1
Water
RJLD Leakage
Expansion Tank
Temp
Level
CIRC
HVPS
Leak
LOAD
IOT 11
IOT 12
IOT 13
IOT 14
Temp
Flow
RJLD 3
RJLD 2
RJLD 1
Air
IOT 1
IOT 2
IOT 3
IOT 4
Flow
Pressure
Temp
TB Filter
ok
TB Fan Status
on
Temp Supervision
ok
Fan Supervision
good
Fan Status
on
Filter Supervision
ok


SR Low Level RF - Cavity 1
SR-RF-LLRF-10
LLRF
ON
LLRF On
RF
ON
RF On
Freq. (tuner) Loop Closed
Software Quench Active
Amp./Phase Loop Closed
Detuning
Vcav Feedback
CW Mode
.5 second
Motor Driver
System 1 Interlock
MO
P-MO
7.24
dBm
RF Power Limit
Reset P.Limit
Software Quench
Reset S.Quench
Hardware Quench
Reset H.Quench
Tuner Limit Switch
Waveguide Switch
Vcav max
1.100
MV
Start
Stop
Vcav meas.
1.10
MV
Cavity Phi
17.25
deg
Vcav
1.100
MV
Down / Up
Pfor
168.60
kW
Pref
7.11
kW
Frequency Loop
PID on
Tuner Moving
Target Phi Diff
-35.0
deg
Detuning:
OFF
Angle
66.0
deg
Measured Phi Diff
-35.23
deg
Amp./Phase Loop
closed
Gain I
42
Gain Q
42
Expert Screen
Shrink Window
iocStats
Close
Vcav
1.10
MV
Cavity Phi
17.25
deg
time, 0.1s
Pfor
168.60
kW
Pref
7.11
kW
Position
862.08 Hz


SR Low Level RF - Cavity 1
SR-RF-LLRF-10
LLRF
ON
LLRF On
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Freq. (tuner) Loop Closed
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Amp./Phase Loop Closed
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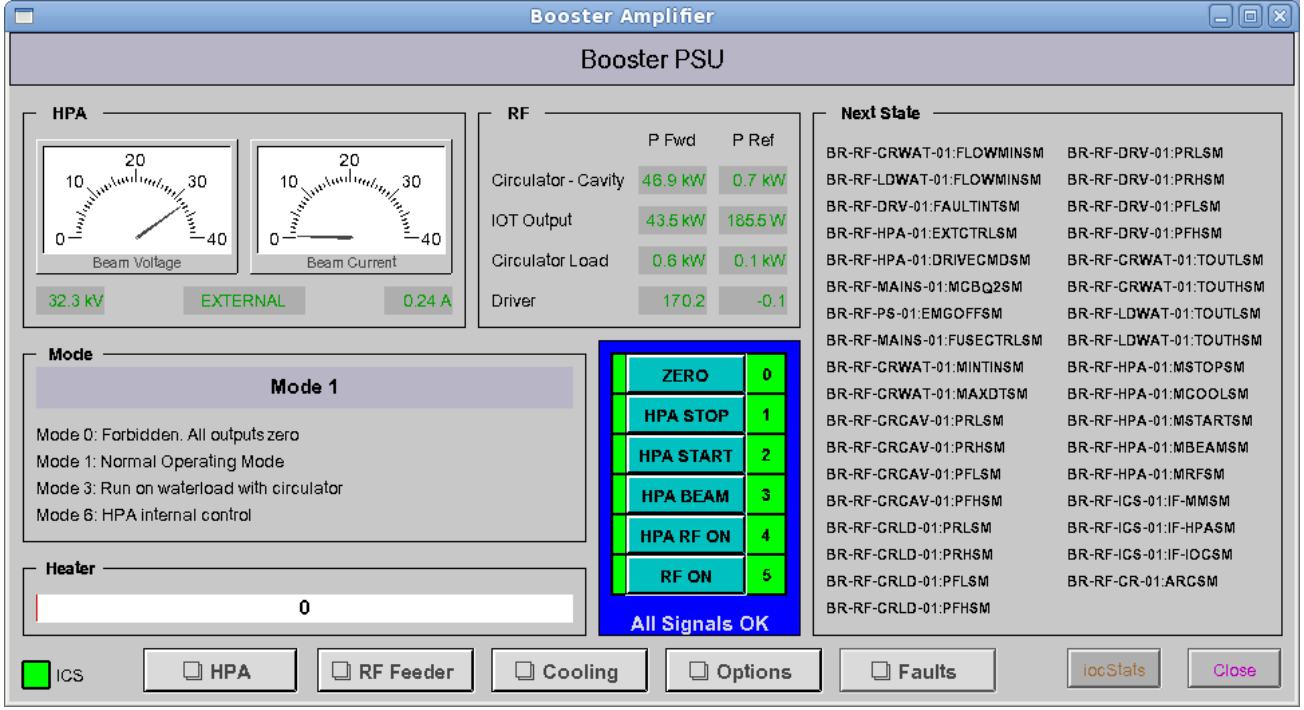
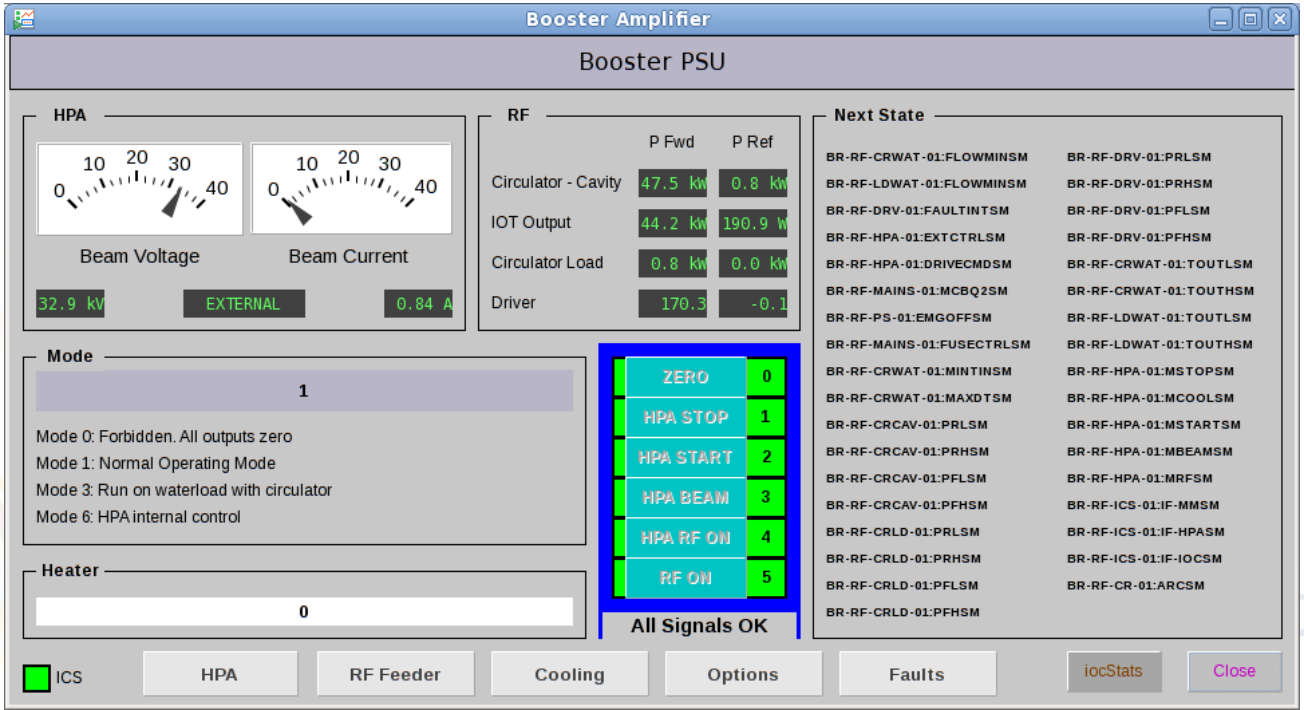
Vcav Feedback
CW Mode
.5 second
Motor Driver
System 1 Interlock
MO
P-MO
7.24
dBm
RF Power Limit
Reset P.Limit
Software Quench
Reset S.Quench
Hardware Quench
Reset H.Quench
Tuner Limit Switch
Waveguide Switch
Vcav max
1.100
MV
Start
Stop
Vcav meas.
1.10
MV
Cavity Phi
17.30
deg
Vcav
1.100
MV
Pfor
168.38
kW
Pref
7.26
kW
Frequency Loop
PID on
Tuner Moving
Target Phi Diff
-35.0
deg
Detuning:
OFF
Angle
66.0
deg
Measured Phi Diff
-35.35
deg
Amp./Phase Loop
closed
Gain I
42
Gain Q
42
Expert Screen
Shrink Window
iocStats
Close
Vcav
1.10
MV
Cavity Phi
17.30
deg
time, 0.1s
Pfor
168.38
kW
Pref
7.26
kW
Position
808.32 Hz


Booster Amplifier
Booster PSU
HPA
Beam Voltage
Beam Current
32.3 kV
EXTERNAL
0.24 A
RF
P Fwd
P Ref
Circulator - Cavity
46.9 kW
0.7 kW
IOT Output
43.5 kW
185.5 W
Circulator Load
0.6 kW
0.1 kW
Driver
170.2
-0.1
Next State
BR-RF-CRWAT-01:FLOWMINSM
BR-RF-LDWAT-01:FLOWMINSM
BR-RF-DRV-01:FAULTINTSM
BR-RF-HPA-01:EXTCTRLSM
BR-RF-HPA-01:DRIVECMDSM
BR-RF-MAINS-01:MCBQ2SM
BR-RF-PS-01:EMGOFFSM
BR-RF-MAINS-01:FUSECTRLSM
BR-RF-CRWAT-01:MINTINSM
BR-RF-CRWAT-01:MAXDTSM
BR-RF-CRCAV-01:PRLSM
BR-RF-CRCAV-01:PRHSM
BR-RF-CRCAV-01:PFLSM
BR-RF-CRCAV-01:PFHSM
BR-RF-CRLD-01:PRLSM
BR-RF-CRLD-01:PRHSM
BR-RF-CRLD-01:PFLSM
BR-RF-CRLD-01:PFHSM
BR-RF-DRV-01:PRLSM
BR-RF-DRV-01:PRHSM
BR-RF-DRV-01:PFLSM
BR-RF-DRV-01:PFHSM
BR-RF-CRWAT-01:TOUTLSM
BR-RF-CRWAT-01:TOUTHSM
BR-RF-LDWAT-01:TOUTLSM
BR-RF-LDWAT-01:TOUTHSM
BR-RF-HPA-01:MSTOPSM
BR-RF-HPA-01:MCOOLSM
BR-RF-HPA-01:MSTARTSM
BR-RF-HPA-01:MBEAMSM
BR-RF-HPA-01:MRFSM
BR-RF-ICS-01:IF-MMSM
BR-RF-ICS-01:IF-HPASM
BR-RF-ICS-01:IF-IOCSM
BR-RF-CR-01:ARCSM
Mode
Mode 1
Mode 0: Forbidden. All outputs zero
Mode 1: Normal Operating Mode
Mode 3: Run on waterload with circulator
Mode 6: HPA internal control
Heater
0
ZERO 0
HPA STOP 1
HPA START 2
HPA BEAM 3
HPA RF ON 4
RF ON 5
All Signals OK
ICS
HPA
RF Feeder
Cooling
Options
Faults
iocStats
Close


Booster Amplifier
Booster PSU
HPA
Beam Voltage
Beam Current
32.9 kV
EXTERNAL
0.84 A
RF
P Fwd
P Ref
Circulator - Cavity
47.5 kW
0.8 kW
IOT Output
44.2 kW
190.9 W
Circulator Load
0.8 kW
0.0 kW
Driver
170.3
-0.1
Next State
BR-RF-CRWAT-01:FLOWMINSM
BR-RF-LDWAT-01:FLOWMINSM
BR-RF-DRV-01:FAULTINTSM
BR-RF-HPA-01:EXTCTRLSM
BR-RF-HPA-01:DRIVECMDSM
BR-RF-MAINS-01:MCBQ2SM
BR-RF-PS-01:EMGOFFSM
BR-RF-MAINS-01:FUSECTRLSM
BR-RF-CRWAT-01:MINTINSM
BR-RF-CRWAT-01:MAXDTSM
BR-RF-CRCAV-01:PRLSM
BR-RF-CRCAV-01:PRHSM
BR-RF-CRCAV-01:PFLSM
BR-RF-CRCAV-01:PFHSM
BR-RF-CRLD-01:PRLSM
BR-RF-CRLD-01:PRHSM
BR-RF-CRLD-01:PFLSM
BR-RF-CRLD-01:PFHSM
BR-RF-DRV-01:PRLSM
BR-RF-DRV-01:PRHSM
BR-RF-DRV-01:PFLSM
BR-RF-DRV-01:PFHSM
BR-RF-CRWAT-01:TOUTLSM
BR-RF-CRWAT-01:TOUTHSM
BR-RF-LDWAT-01:TOUTLSM
BR-RF-LDWAT-01:TOUTHSM
BR-RF-HPA-01:MSTOPSM
BR-RF-HPA-01:MCOOLSM
BR-RF-HPA-01:MSTARTSM
BR-RF-HPA-01:MBEAMSM
BR-RF-HPA-01:MRFSM
BR-RF-ICS-01:IF-MMSM
BR-RF-ICS-01:IF-HPASM
BR-RF-ICS-01:IF-IOCSM
BR-RF-CR-01:ARCSM
Mode
1
Mode 0: Forbidden. All outputs zero
Mode 1: Normal Operating Mode
Mode 3: Run on waterload with circulator
Mode 6: HPA internal control
Heater
0
ZERO 0
HPA STOP 1
HPA START 2
HPA BEAM 3
HPA RF ON 4
RF ON 5
All Signals OK
ICS
HPA
RF Feeder
Cooling
Options
Faults
iocStats
Close

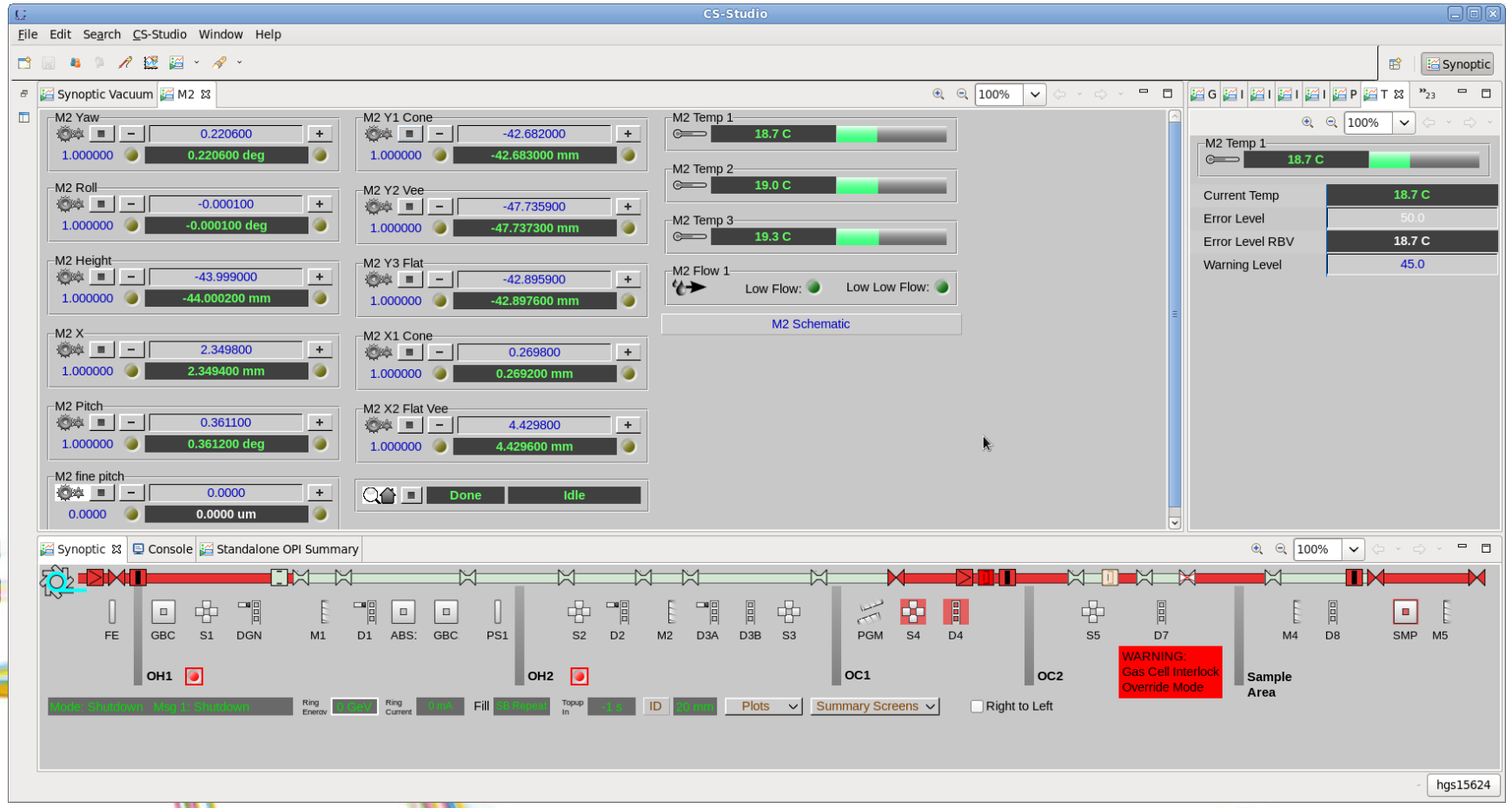
Upshot

- This is tricky
- Integrating with existing systems has taken a lot of time
- Automated conversion is accurate but not perfect
- Each ‘module’ will need its owner to review and approve it
- We will have a period using both EDM and CS-Studio
- 2017?

diamond

Meanwhile

Beamline GUIs are autogenerated. New beamlines are receiving CS-Studio-based GUIs, with a completely different design:



(and are happy)