

Phoebus & CS-Studio

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CS-Studio

17 sites actively packing a site-specific CS-Studio products

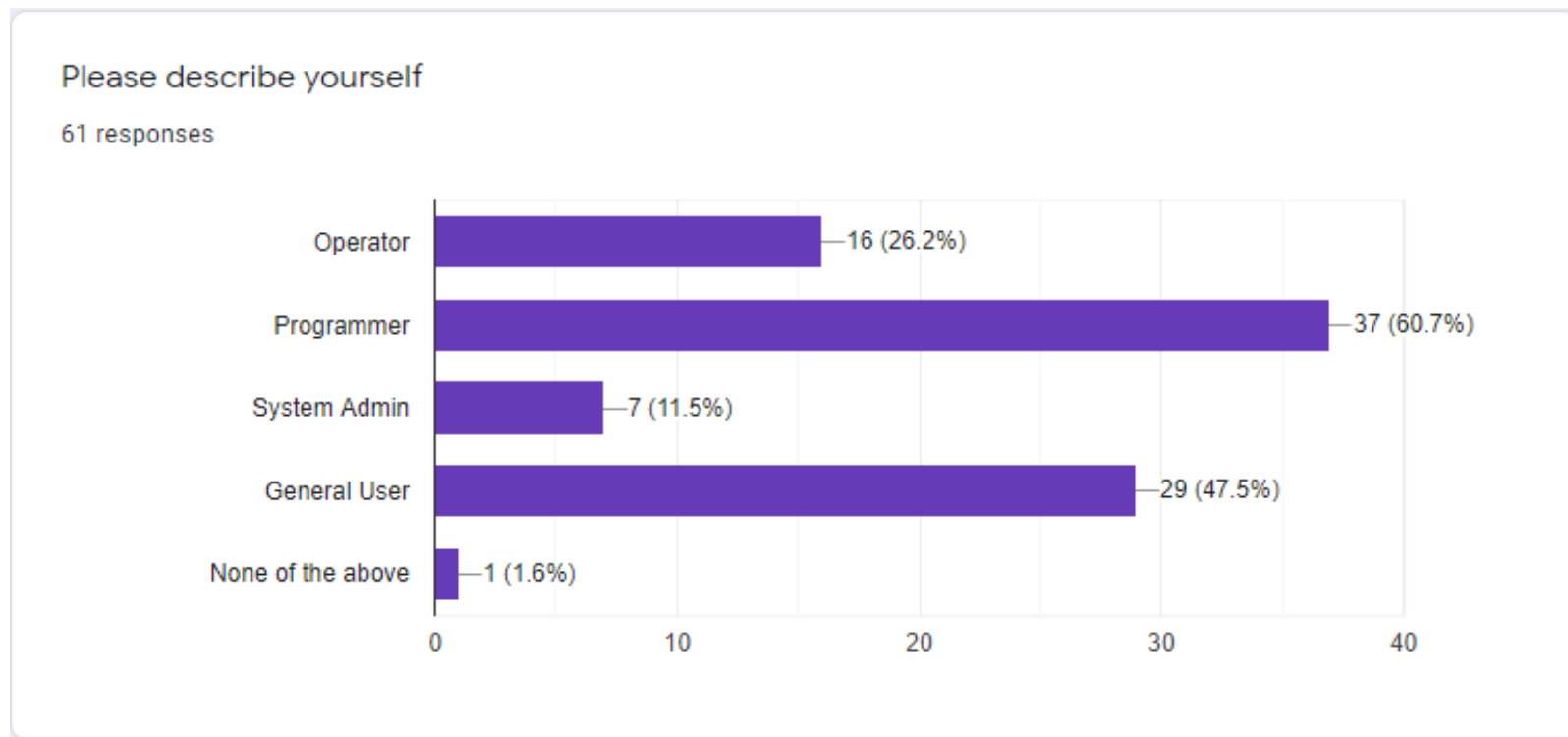
(NSLS2, SNS, ESS, FRIB, ALS, ITER, DLS, ISIS, CEA, NSRCC, KEK, FZB, DESY, CSNS, LNL, ROAN, JLAB,...)

12+ sites/labs/institutions using prepackaged products

CS-Studio Survey (2018):

Over 24 Institutions

62 participants



Survey findings

“When it works, I like it.”

“right click -> send PV name to another plug-in saves me a lot of time”

“I like the concept of a well integrated set of tools that can share data.”

“Integration of the olog, channel navigator, and chart/archiver features are useful.”

“Very helpful collaboration.”

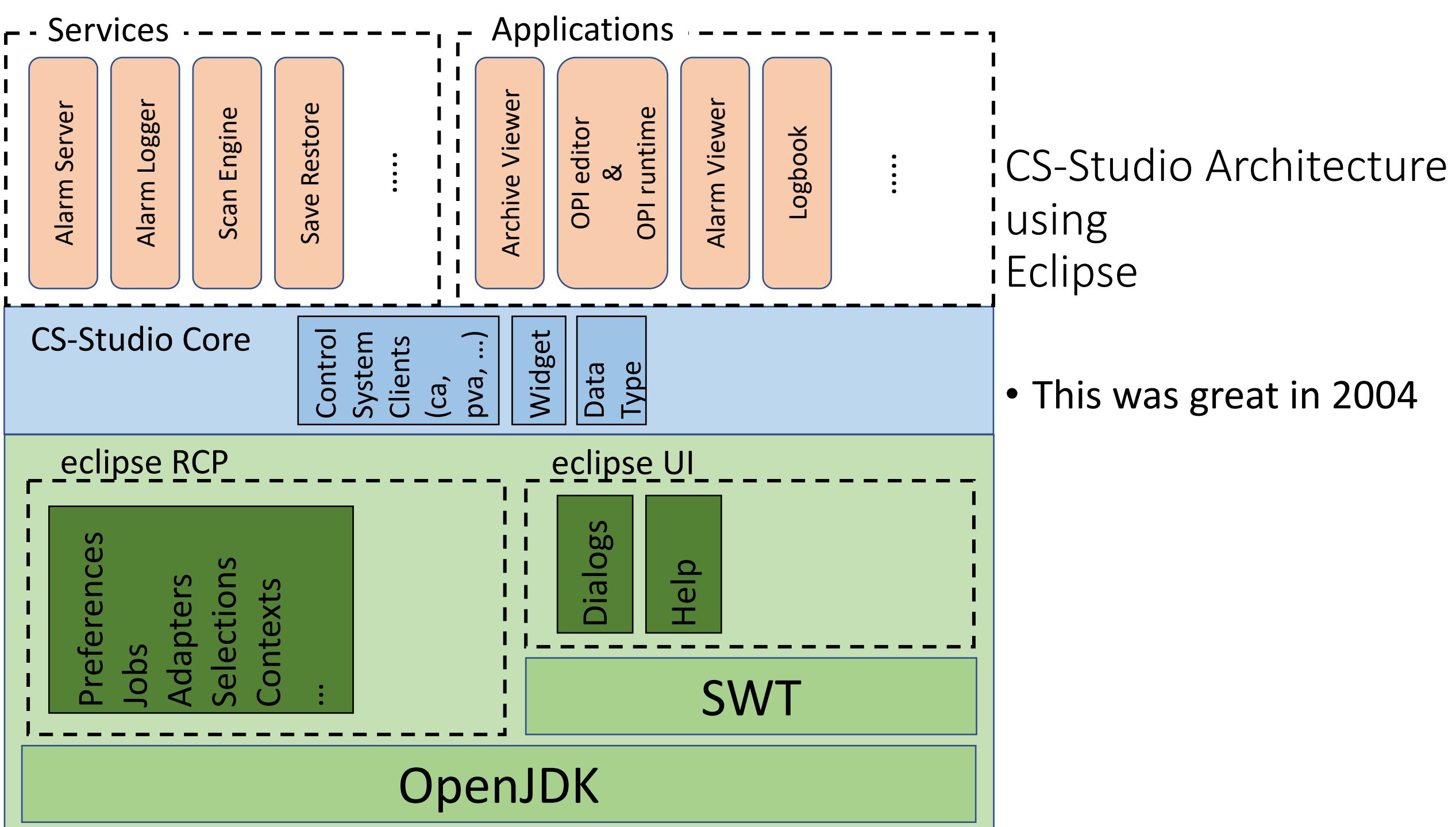
“Easy to create GUI's that interact with EPICS PV's”

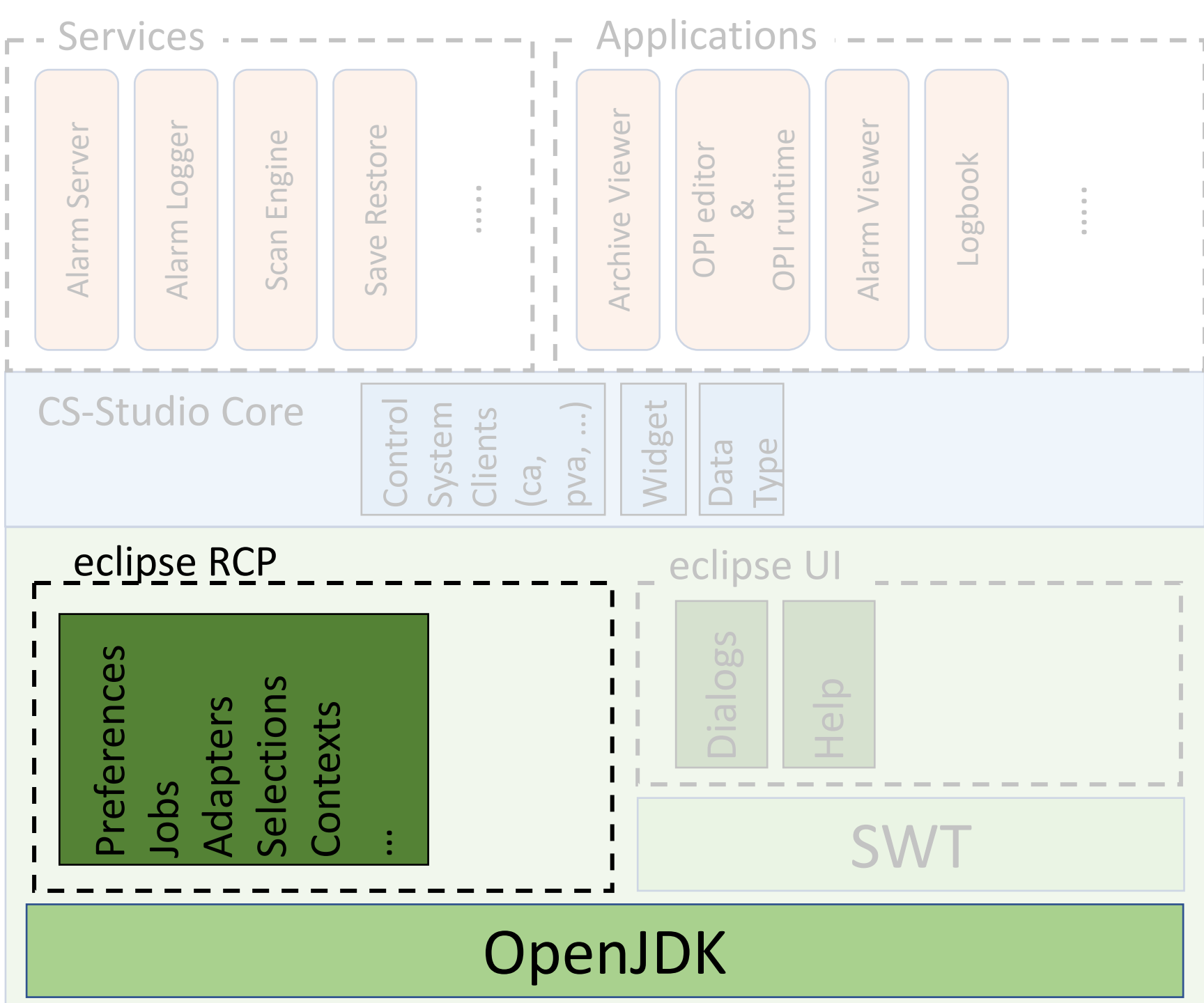
“When it does not work, I hate it.”

“I am having real problems building our own CSS distribution starting from Eclipse Mars RC2”

“Big labs seem to have their experts but I'm under the impression that smaller labs are struggling and so am I when "my expert" is not available.”

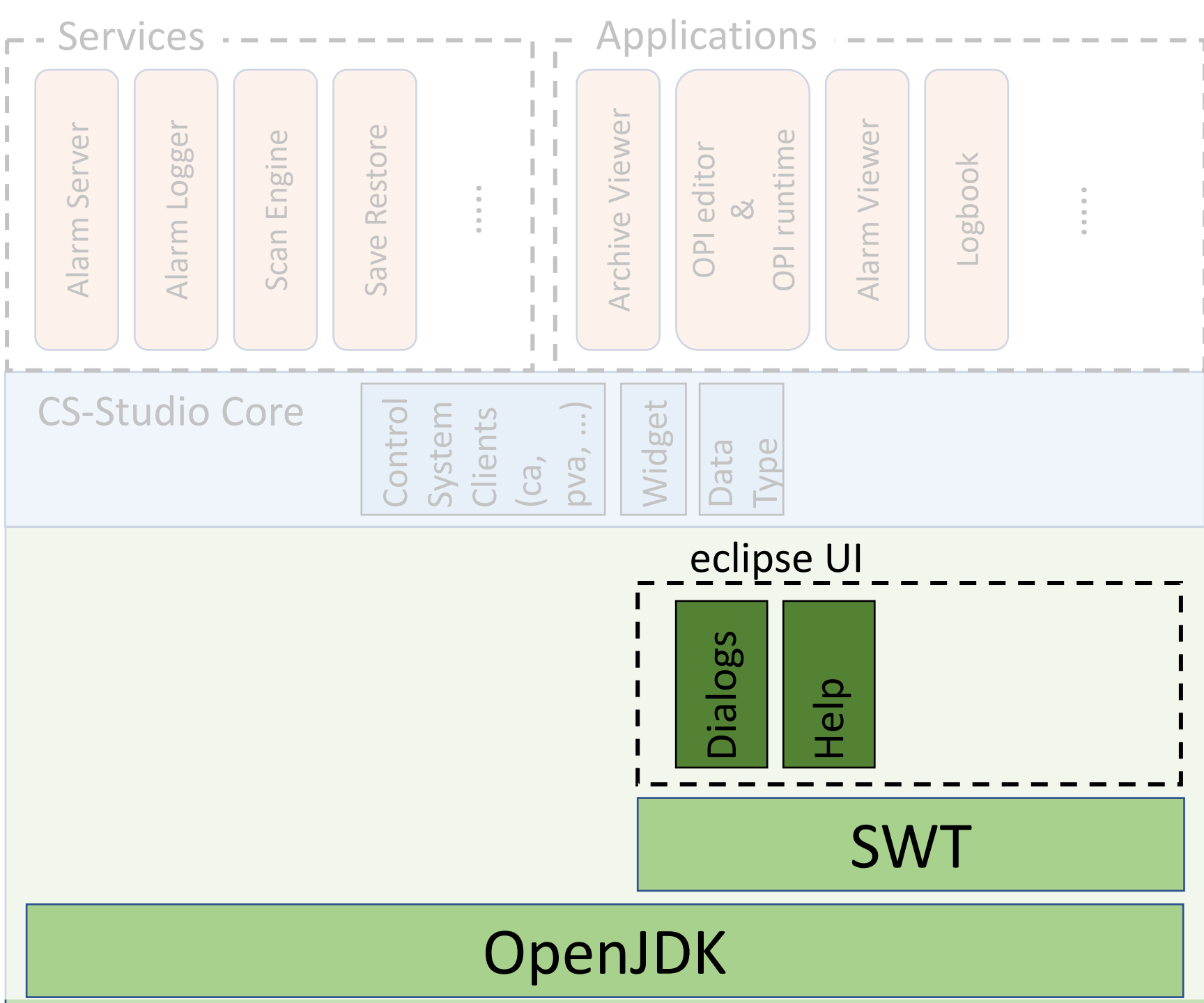
“Spend a long time to start a product in Eclipse and Export it.”





CS-Studio Architecture using Eclipse

- Most of the features are now part of the jdk
 - Modules
 - SPI
 - Preferences
- Eclipse RCP is strongly tied to SWT



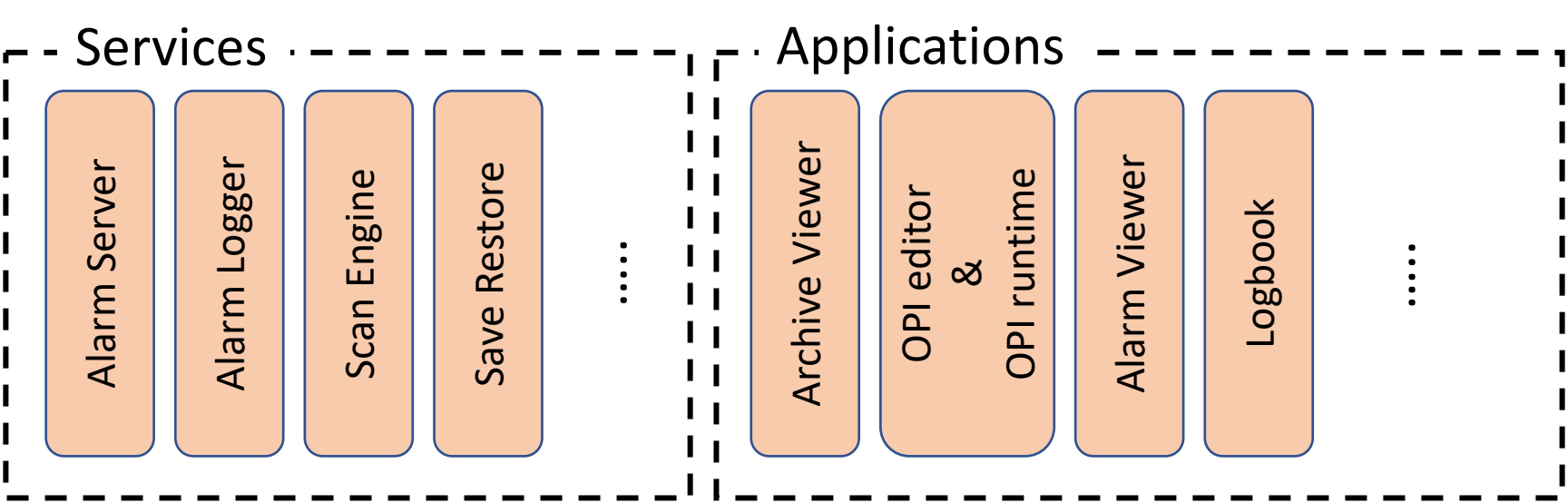
CS-Studio Architecture using Eclipse

- SWT aims to provide native look and feel
- Poor performance on Linux systems

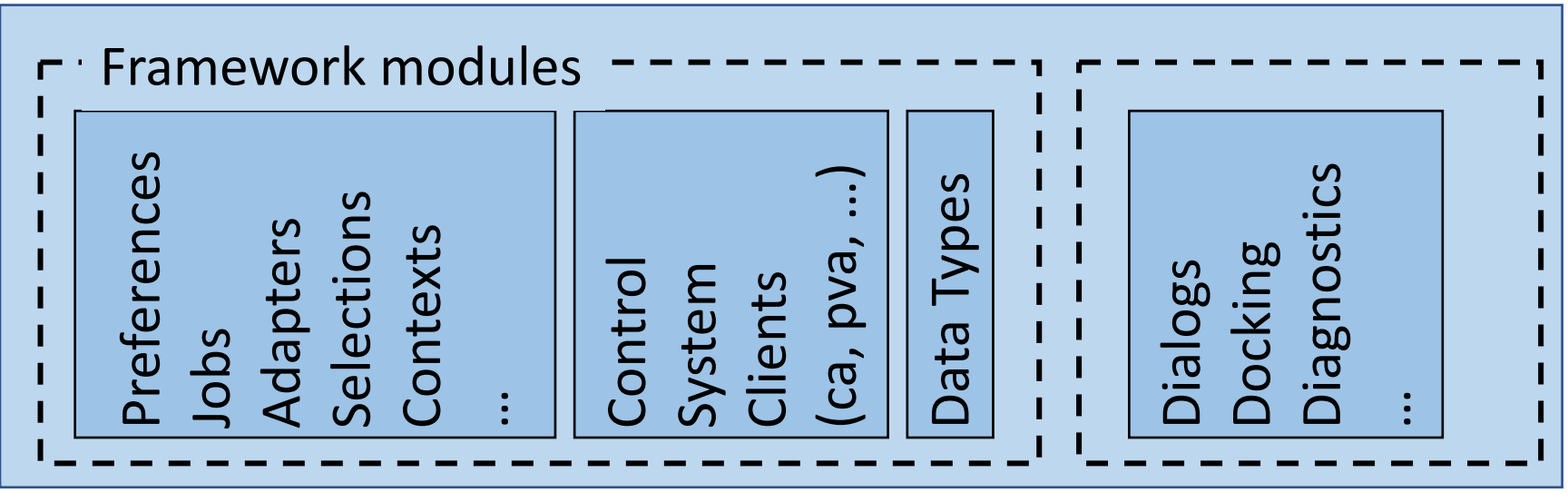
Stepping into the Sun

Phoebus : literally "bright".
pronunciation: /'fi:bəs/ FEE-bəs; Φοῖβος

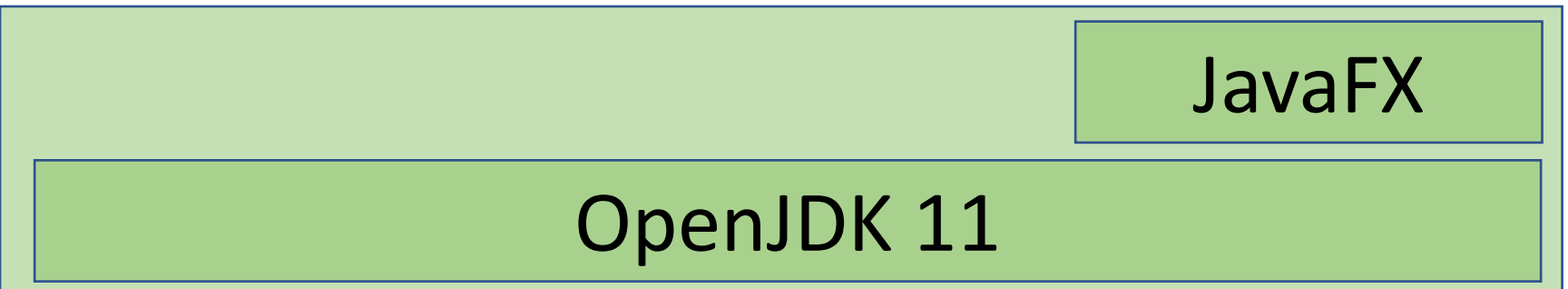




Phoebus architecture



- Eclipse RCP replaced with OpenJDK &
- SWT replaced with javaFX



Eclipse RCP → Phoebus framework

- Java JDK
 - Preferences
 - Modules
 - SPI's
- Phoebus services
 - Context Service
 - Selection Service
 - Adapter Service

Name	Owner	elemField
SR:C01-MG{PS:CH1B}!Ps1DCCT1-I	cf-update	x
SR:C01-MG{PS:CH1B}!Ps2DCCT1-I		
SR:C01-MG{PS:CH1B}!Sp1-SP		
SR:C01-MG{PS:CH1B}!Sp2-SP		
SR:C01-MG{PS:CH2B}!Ps1DCCT1-I		
SR:C01-MG{PS:CH2B}!Ps2DCCT1-I		
SR:C01-MG{PS:CH2B}!Sp1-SP		
SR:C01-MG{PS:CH2B}!Sp2-SP		
SR:C01-MG{PS:CL1A}!Ps1DCCT1-I		
SR:C01-MG{PS:CL1A}!Ps2DCCT1-I		
SR:C01-MG{PS:CL1A}!Sp1-SP		
SR:C01-MG{PS:CL1A}!Sp2-SP		
SR:C01-MG{PS:CL2A}!Ps1DCCT1-I		
SR:C01-MG{PS:CL2A}!Ps2DCCT1-I		
SR:C01-MG{PS:CL2A}!Sp1-SP		

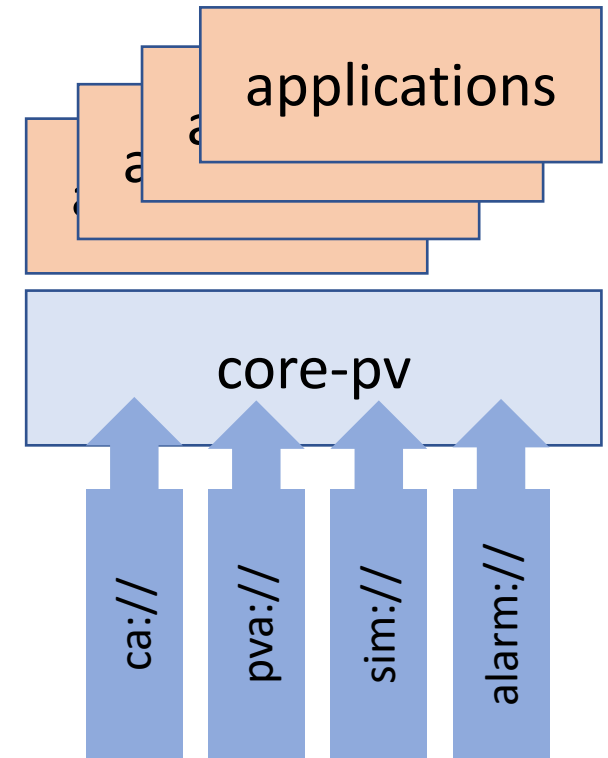
- Add Property
- Add tag
- Remove Property
- Remove Tag
- Alarm History
- Channel Info
- Copy PV to Clipboard
- Create/add to a Saveset
- Data Browser
- PV Table
- PV Tree
- Probe
- Probe Display

Eclipse RCP → Phoebus framework

- Pluggable and Modular

Java SPI's provide a powerful framework for creating a pluggable framework

- Lesser Code
- Unit, Integration, & GUI tests
- Better Build system
 - Fast
 - Easy
 - Modular
 - Reproducible



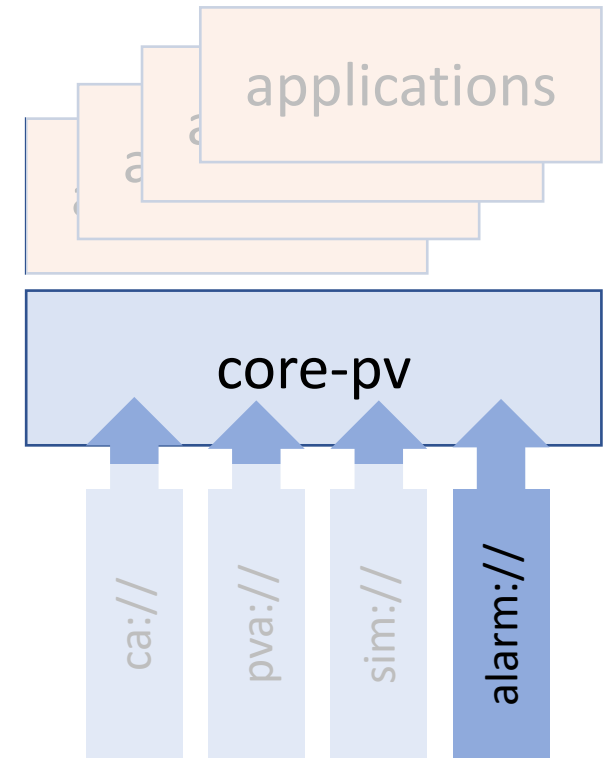
```
[INFO] -----  
[INFO] Reactor Summary:  
[INFO] phoebus (parent) 4.6.4-SNAPSHOT ..... SUCCESS [ 1.987 s]  
[INFO] dependencies ..... SUCCESS [ 0.018 s]  
[INFO] install-jars ..... SUCCESS [ 4.569 s]  
[INFO] phoebus-target ..... SUCCESS [ 9.595 s]  
[INFO] core ..... SUCCESS [ 0.012 s]  
[INFO] -----  
[INFO] BUILD SUCCESS  
[INFO] -----  
[INFO] Total time: 03:21 min  
[INFO] Finished at: 2020-10-13T11:03:33-04:00  
[INFO] -----
```

Phoebus framework

e.g. Alarm Datasource

alarm://NSLS2_OPR/SR/PowerSupply

- A new datasource to retrieve information from the Alarm server
 - Acknowledge & Unacknowledged
 - Enabled & Disabled
 - Duration of the alarm

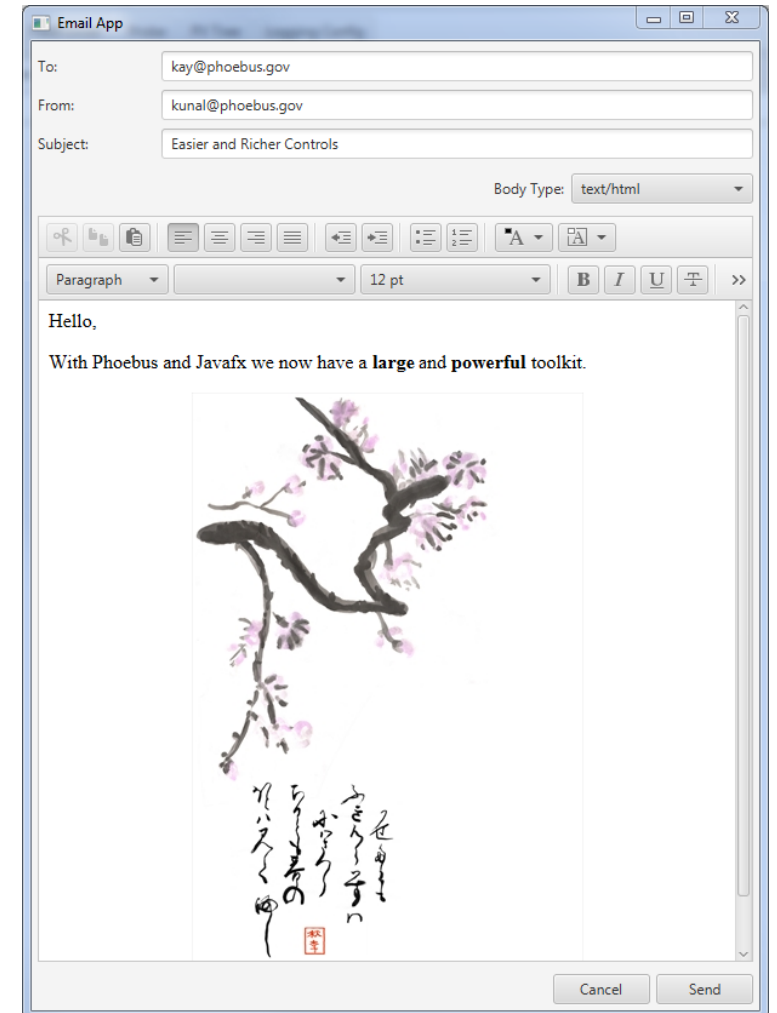


SWT → javaFX

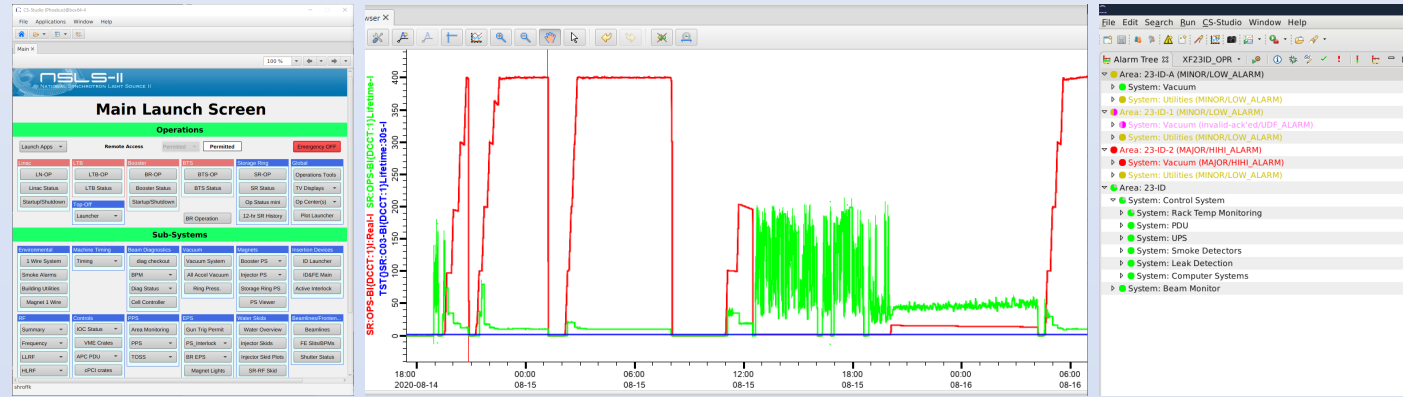


SWT vs javaFX

- Better look and feel
- Better performance
- Lesser code
- javaFX greatly facilitates the MVC design pattern



Phoebus

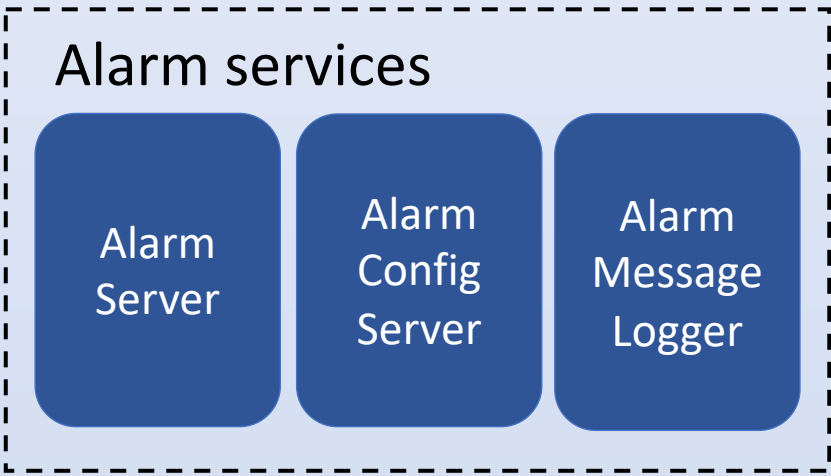


Client

Channel Finder

MASAR Save & Restore

Archiver



EPICS services



Channel Access IOC

PVA IOC

...

Control Systems

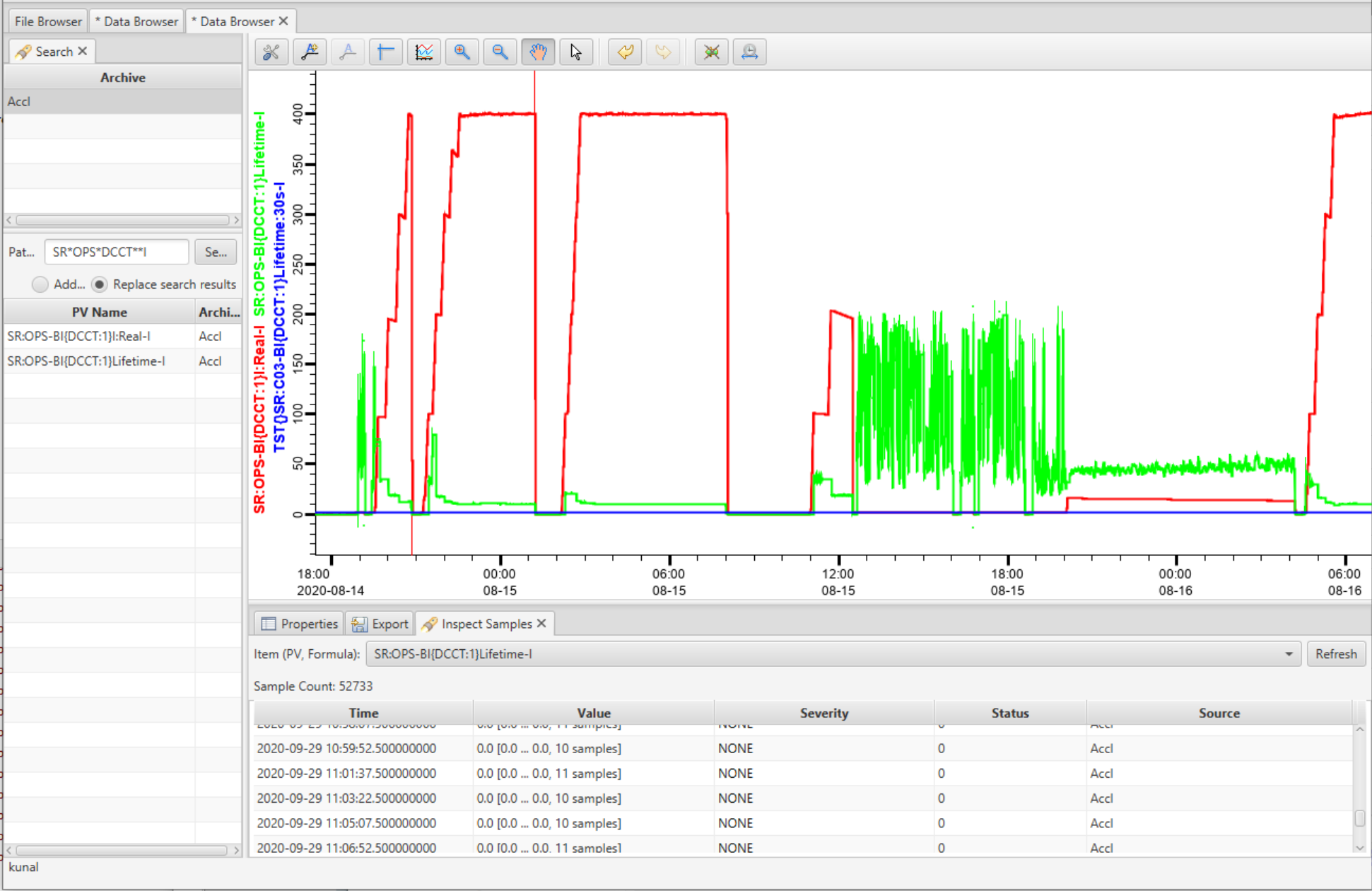
Phoebus for Users:

Most applications have been converted (and improved)

- Alarm views
- Databrowser
- Logbook
- ChannelFinder
- Save restore
- Diagnostic tools (probe, pvtree, ...)
- Utility tools (email, therapist, ...)

Some New Applications have been added

- HDF Viewer
- Alarm logging
- Console
- Log calendar



DataBrowser 3

Visualizing archived and live data

Supported for multiple archiver

- Archiver Appliance
- RDB archiver
- Channel Access Archiver
-

File Browser | Log Entry Calendar X

Query: desc=*&limit=200

Time	Log	Logbook/Tags
2020-10-14 08:17:52 rfiller	Succeed to save a snapshot #4147 to MASAR database using Conifg LN-LTB-All-20131219 with description: Linac Kly 1 and Kly 2 ,6 nC/shot goos booster injection. Comment: Saving Tweaked up booster ▶ Attachments	Operations MASAR
2020-10-14 07:59:38 santana	October 13-14 2000-0800 Shift Summary Lead Operator: M.Santana QO: P.Marino FLOCO: L.Pharr BNL Limited Operations – Phase 2 Injector startup SR RF conditioning w/o beam Cavity C at 1600kV Cavity D at 1550kV Injector startup/training with T.Santiago under the direction of R.Fillier. Masar files saved for tuning beam to the booster dump. SR is setup for bare lattice with ID gaps opened in preparation for SRinj with APS-U stripline. ▶ Attachments	Operations Summary
2020-10-14 07:46:23 rfiller	Succeed to save a snapshot #4146 to MASAR database using Conifg LN-LTB-All-20131219 with description: Linac Kly1 and Kly 2 - retuned single bunch. Comment: Tweaking up single bunch mode ▶ Attachments	Operations MASAR
2020-10-14 07:32:35 rfiller	successfully restore machine with the snapshot #4145 of Conifg LN-LTB-All-20131219 ▶ Attachments	Operations MASAR
2020-10-14 05:05:38 santana	successfully restore machine with the snapshot #3625(filtered with pattern *c03*) of Conifg SR_Quad_Sext_DAC_Cal ▶ Attachments	Operations MASAR
2020-10-13 22:39:50 santana	SR setup with bare lattice and ID gaps open in preparation for SRinj with APS-U stripline. ▶ Attachments	Operations

File Browser | Log Entry Calendar X

Query: desc=*&limit=200

Time	Log	Logbook/Tags
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2020-10-13 22:39:50 santana	SR setup with bare lattice and ID gaps open in preparation for SRinj with APS-U stripline. ▶ Attachments	Operations

2020-10-11T16:06:27

SR RF Cavity D nitrogen exhaust temp too low alarm came in at 1000 hrs. I see that J.Papu made an adjustment (log browser). Message left on his phone

Logbooks:
Operations

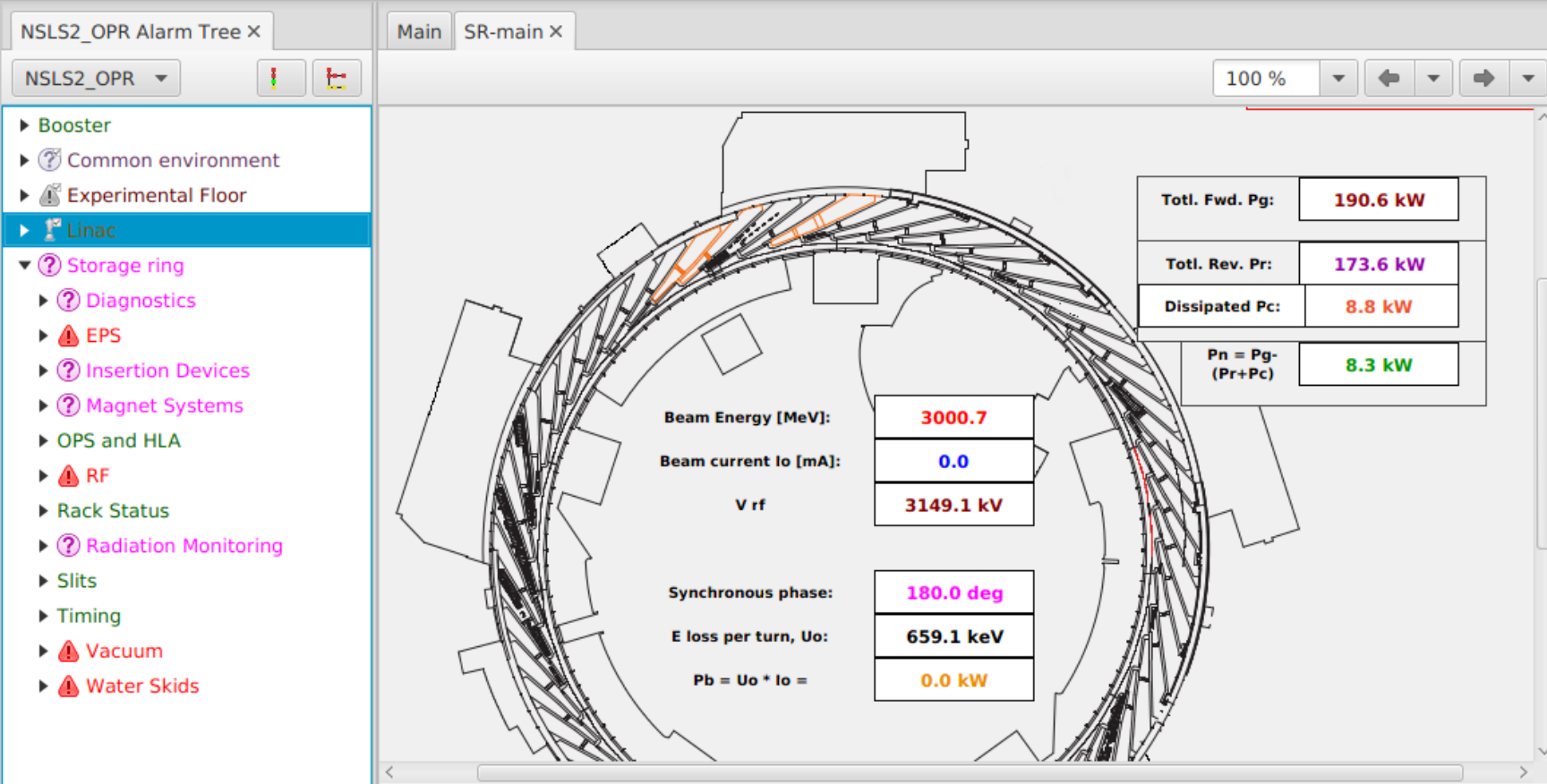
Tags:
RF Systems

Logbook applications

- Logbook table view
- Logbook Calendar View

Supported for multiple logbook services.

- Olog
- Olog-es
- SNS logbook
- elog



Alarm Applications

- Alarm Tree
- Alarm Table
- Alarm Panel
- Alarm Annunciators

NSLS2_OPR Alarm Table x

Active Alarms: 219 NSLS2_OPR

PV	Description	Alarm Severity	Alarm Status	Alarm Time	Alarm Value
BR-VA{}DB:GV-Sts	Booster Gate Valve Status	MAJOR	STATE_ALARM	2020-10-10 19:22:30.246	Error
FE:C02A-VA{}P:GV1GV2Avg-I	Cell 2 Front End Average Vacuum	MINOR	HIGH_ALARM	2020-10-13 08:45:18.844	1.46912E
FE:C03A-VA{}P:GV1GV2Avg-I	Cell 3 Front End Average Vacuum	MINOR	HIGH_ALARM	2020-10-13 11:58:40.108	1.76E-8

Acknowledged Alarms: 4

PV	Description	Alarm Severity	Alarm Status	Alarm Time	Alarm Value
LTB-BI:BD1{VF:1}Alarm-Sts	LTB BD1 Flag 1	MINOR_ACK	STATE_ALARM	2020-10-14 09:46:23.408	Filter Pos
OP-CT{IOC:opinc}.HFARTREAT	op inc status	UNDEFINED_ACK	Disconnected	2020-10-14 00:45:23.533	

Channel Finder

Channel Tree

Creates a hierarchical view of epics pvs.

The pvs can be organized by

- Hostname and IOC
- Device
- ...

The screenshot shows the Channel Finder application interface. At the top, there are tabs for 'File Browser', '* Data Browser', '* Data Browser', and 'Channel Tree X'. Below the tabs is a search bar with the query 'SR* elemType=*'. The main area displays a hierarchical tree of PVs. The tree is expanded to show the following structure:

- SR* elemType=*
 - foflab02
 - psioc-c01
 - ps-C01A
 - cl1g2c01a
 - SR:C01-MG{PS:CL1A}:Ps1DCCT1-I
 - SR:C01-MG{PS:CL1A}:Ps2DCCT1-I
 - SR:C01-MG{PS:CL1A}:Sp1-SP
 - SR:C01-MG{PS:CL1A}:Sp2-SP
 - cl2g2c01a
 - SR:C01-MG{PS:CL2A}:Ps1DCCT1-I
 - SR:C01-MG{PS:CL2A}:Ps2DCCT1-I
 - SR:C01-MG{PS:CL2A}:Sp1-SP
 - SR:C01-MG{PS:CL2A}:Sp2-SP
 - ql1g2c01a
 - ql2g2c01a
 - ql3g2c01a
 - ps-C01B

At the bottom of the tree, it says 'channel count: 1380'. On the right side, there is a detailed view of a selected PV. The fields and their values are:

PV Name:	XF*
Value:	loc://name<VType>(initial value...)
Format:	Formula
Alarm:	=2*`pv_name`
Time Stamp:	Channel finder query
Metadata:	XF16ID-CS{WienerCrate:C2-System}Exinhibit-Sts
	XF23IDA{CAM:1}Stats2:TSControl
	XF23:ID1{EVR:2-Out:RB00}Src:Pulse-RB
	XF:02IDA-BI{Diag:1-Cam:H}Over1:ColorMode
	XF23:ID1{EVR:2-Out:FPUV3}Src:DBus-RB
	XF23IDA{CAM:1}Stats3:TSCurrentPoint
	XF23IDA{CAM:1}ROI1:AutoSizeY
	XF23IDA{CAM:1}ROI1:AutoSizeZ
	XF23IDA{CAM:1}ROI1:AutoSizeX
	XF:02IDA-BI{Diag:1-Cam:H}Over1:2:CenterY
	XF23IDA{CAM:1}Stats4:TSMInValue
	XF:02IDA-BI{Diag:1-Cam:H}Over1:2:CenterX
	XF23:ID1{VME:1}:CA_MAX_ARRAY
	XF23IDA{CAM:1}SR_0_State

Autocomplete

Searches the directory for matching pv names

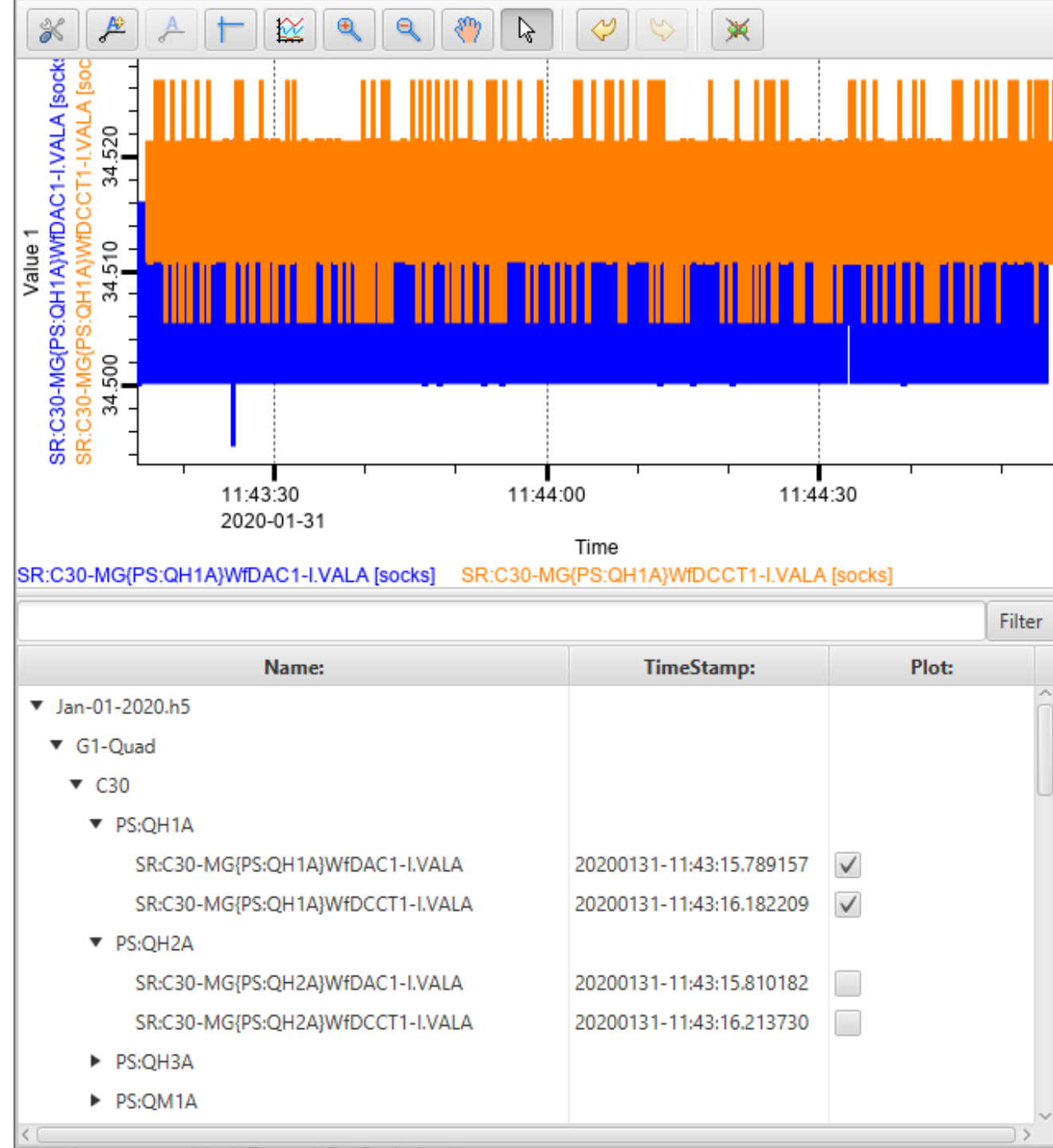
HDF5 support

Utility modules for consuming HDF file
hdf-util

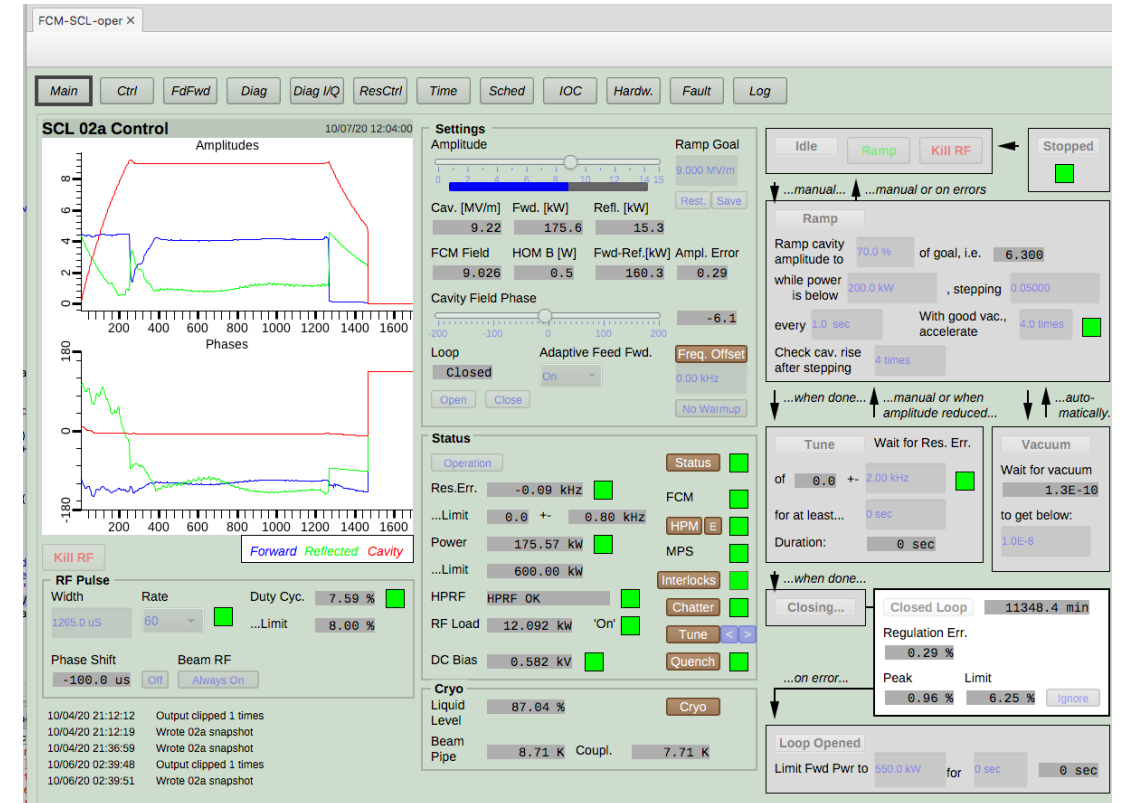
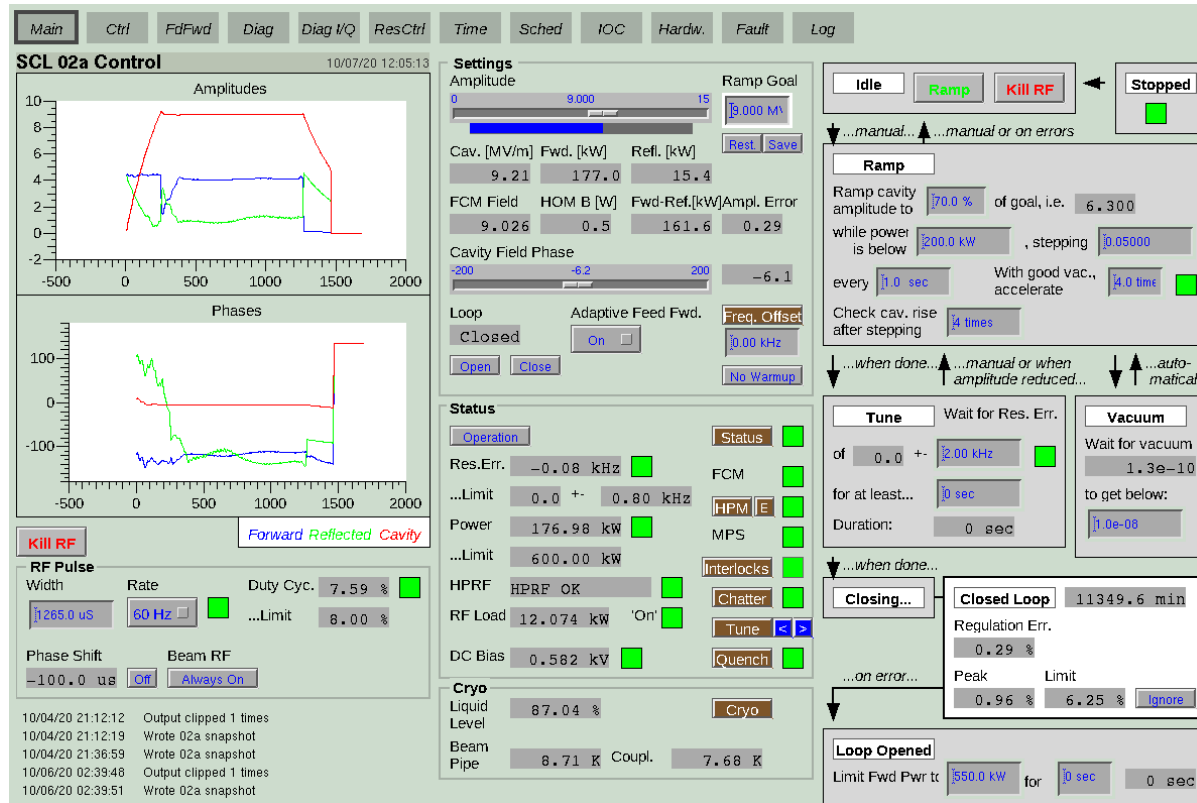
A pluggable interface to contribute specific processors to appropriately interpret and extract data from hdf4 and hdf5 files.

e.g.

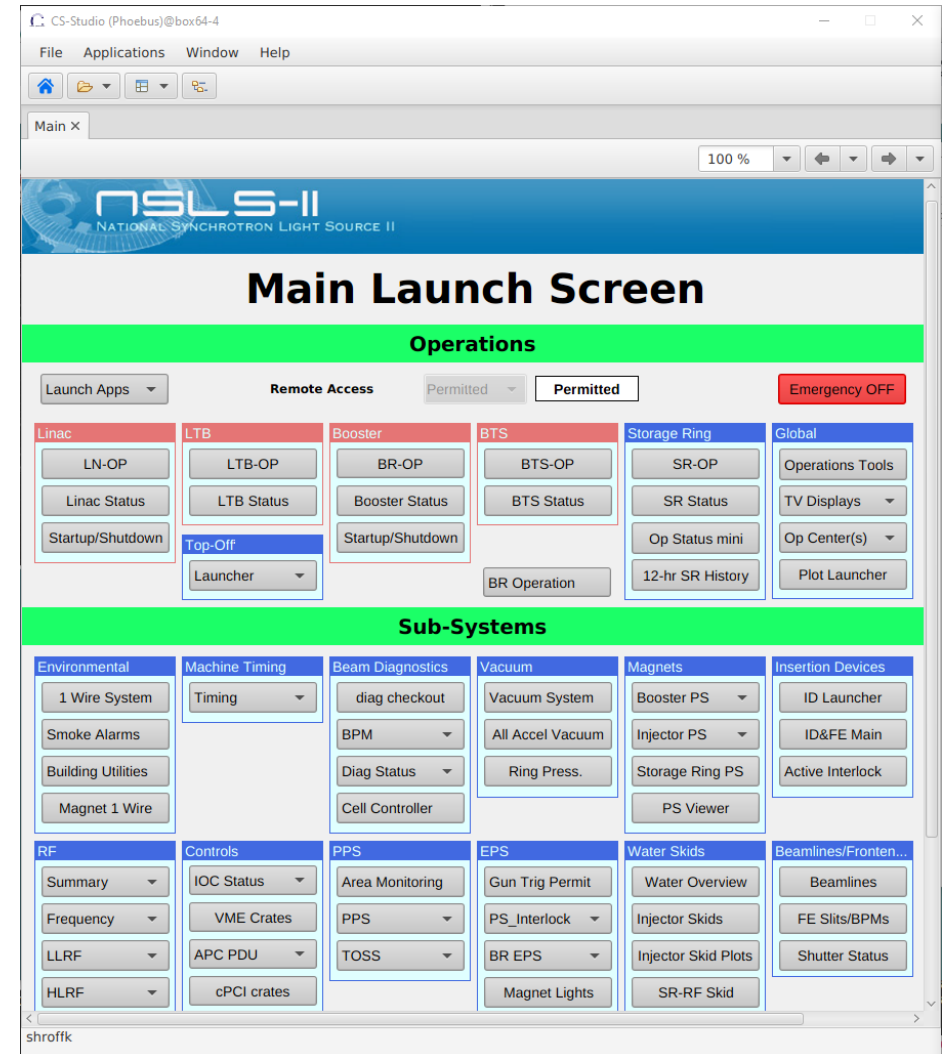
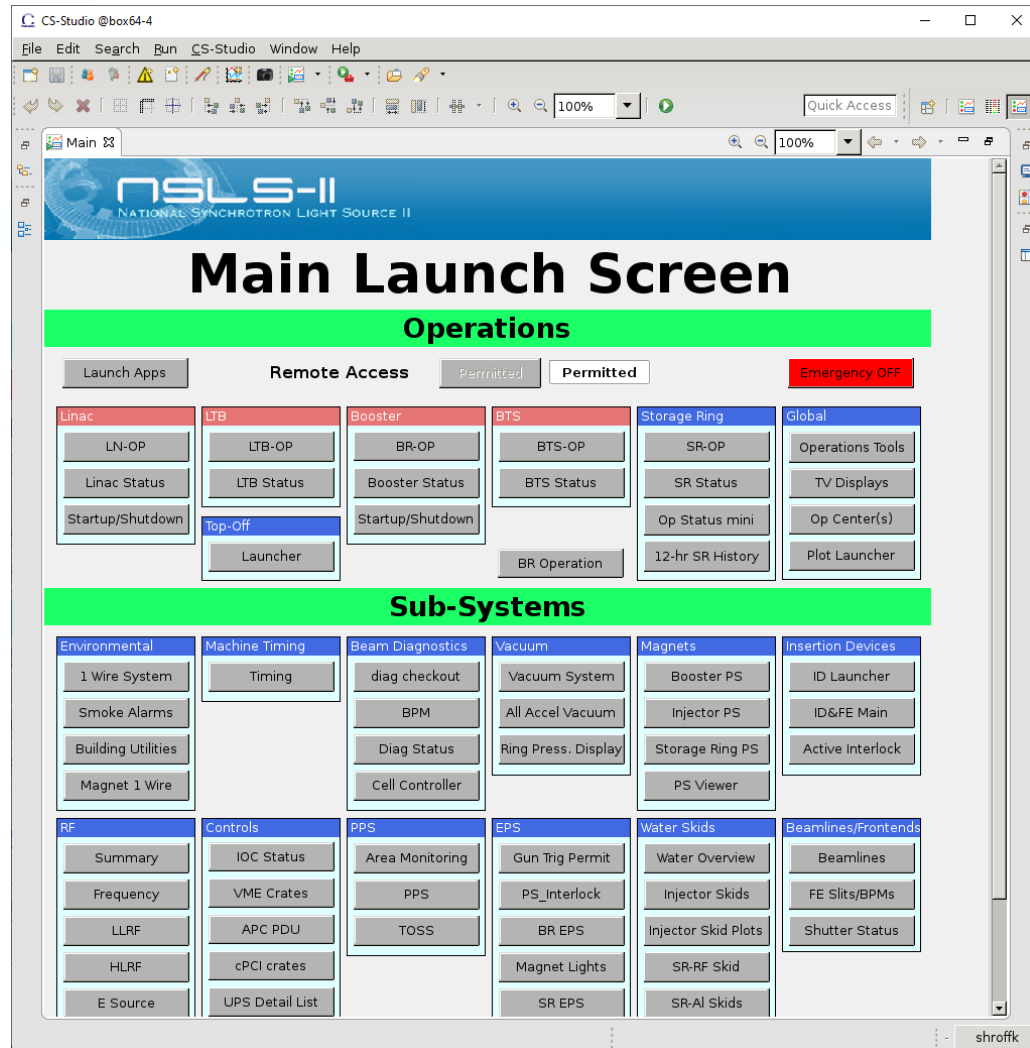
NSLS2 Power Supply fault report



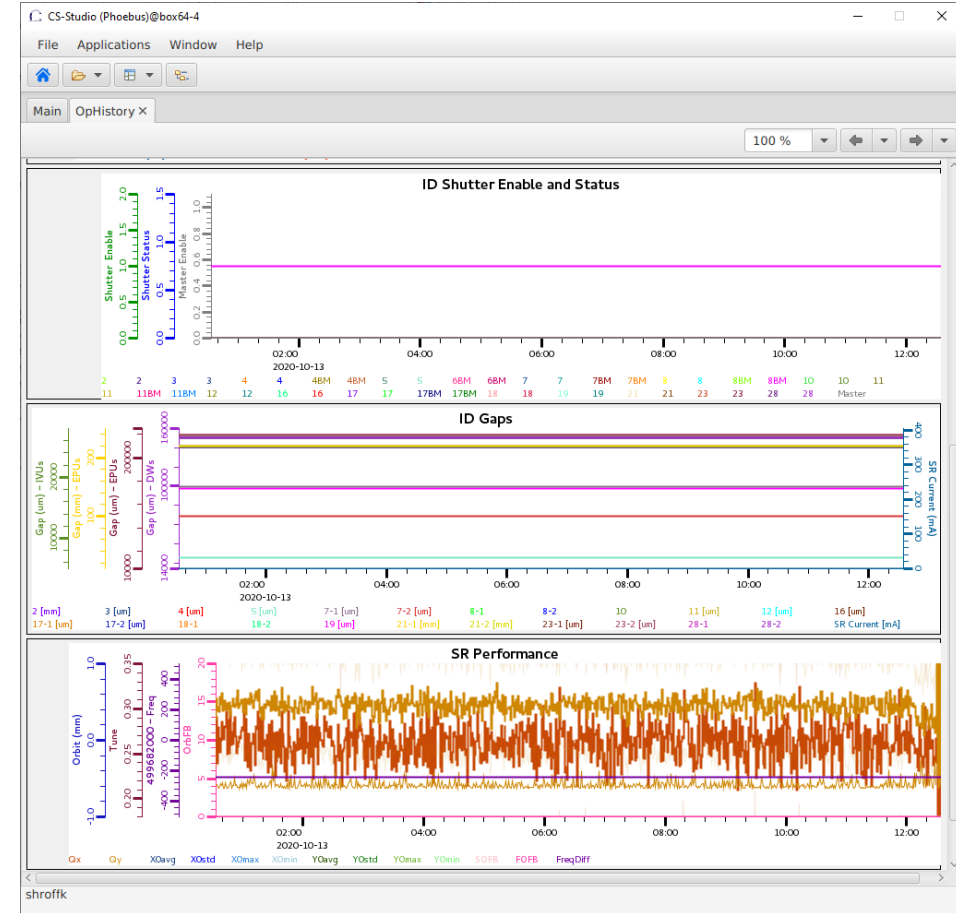
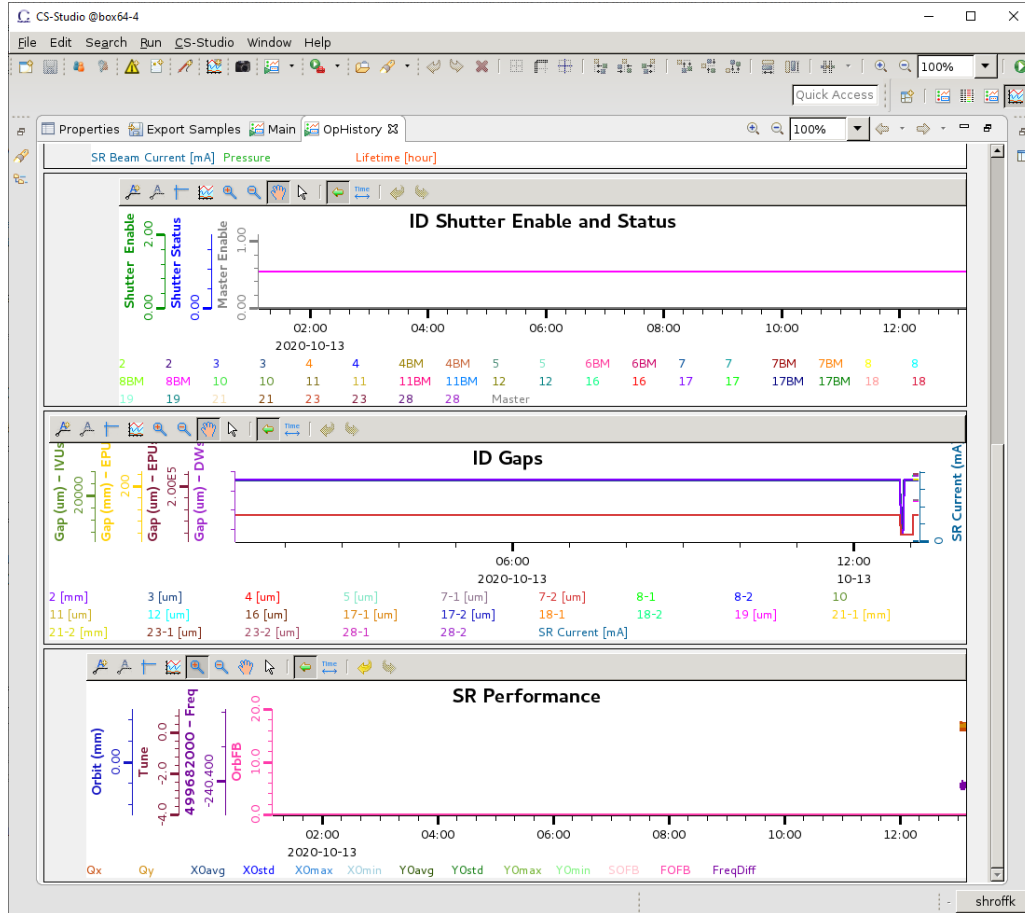
EDM screens converted on runtime



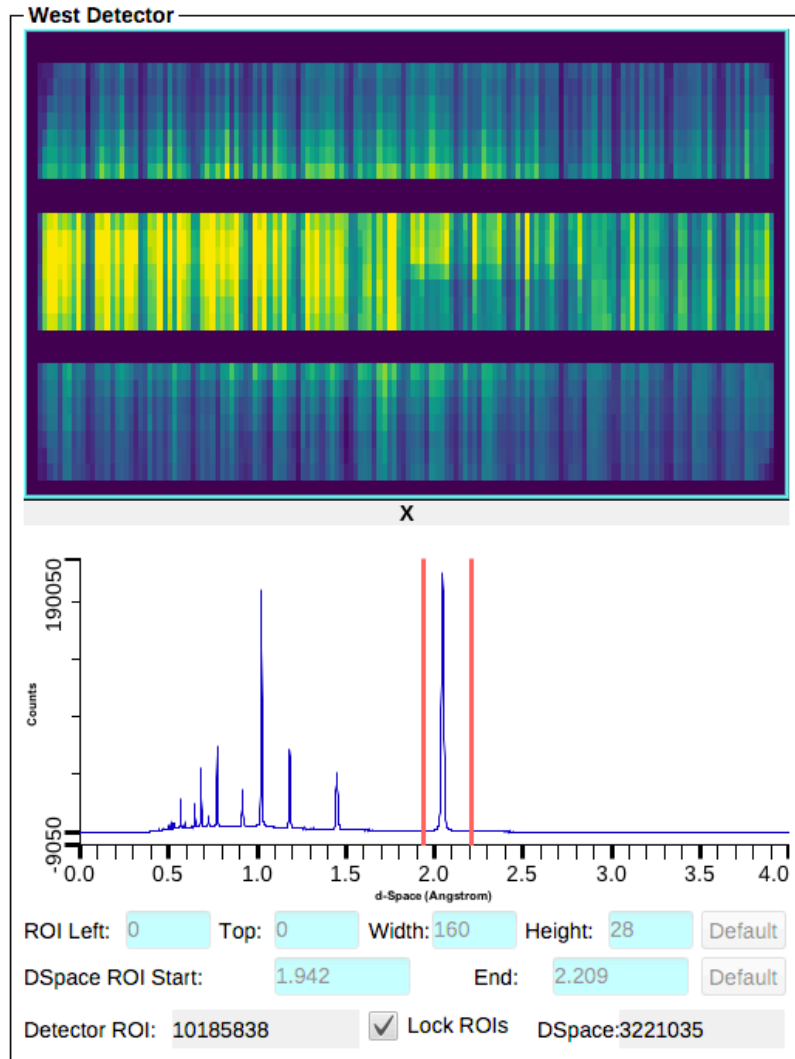
BOY screens converted on runtime



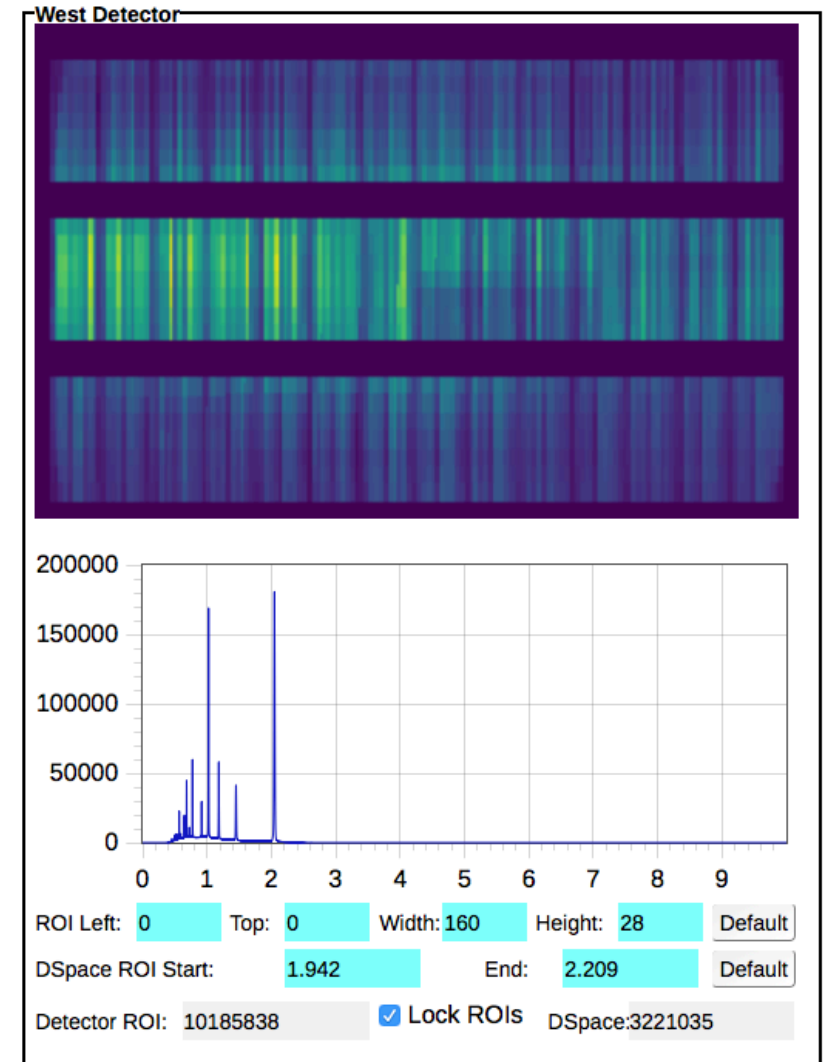
BOY screens converted on runtime (with databrowser)



.bob screens converted on runtime



.bob files converted
to web runtime opi's



Transitioning to Phoebus (Display Builder)

- .edl, .adl, .opi screens are auto converted at runtime
- If the auto converted result isn't perfect

Case 1:

This is a common requirement
The converter it updated to

e.g. [Issue 1564](#)

The borders from BOY were not mapping correctly to DB

Case 2:

The screen consists of many rules and scripts,
complex widgets

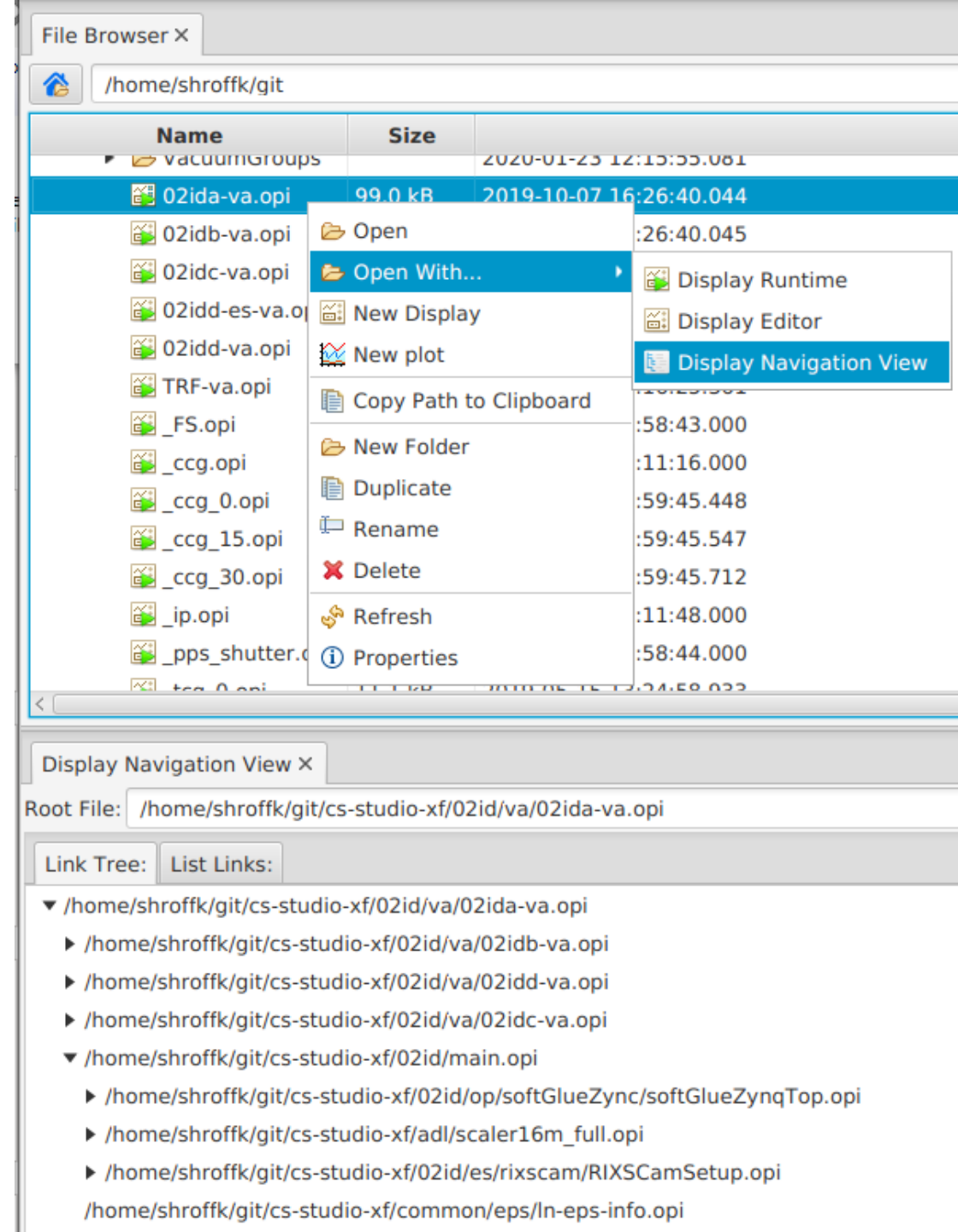
These can be opened in editor with a best effort
conversion (pvnames, marcos, widgets,
layouts,...)

- Once modified the file is stored as a .bob file, future “open” requests will launch .bob files if they are present

Transitioning to Phoebus (Display Builder)

Display Navigation

Creates a tree view of all associated files



Transitioning to Phoebus (Display Builder)

Supporting multiple institutions and timelines

- | | |
|---------------------------|--|
| • SNS, ESS, ALS, HZB, ... | Phoebus |
| • NSLS2, FRIB, ... | Phoebus + eclipse based CS-Studio |
| • ITER, ... | Phoebus services + eclipse based CS-Studio |
| • DLS, ISIS, ... | eclipse based CS-Studio |

Phoebus supported on many platforms



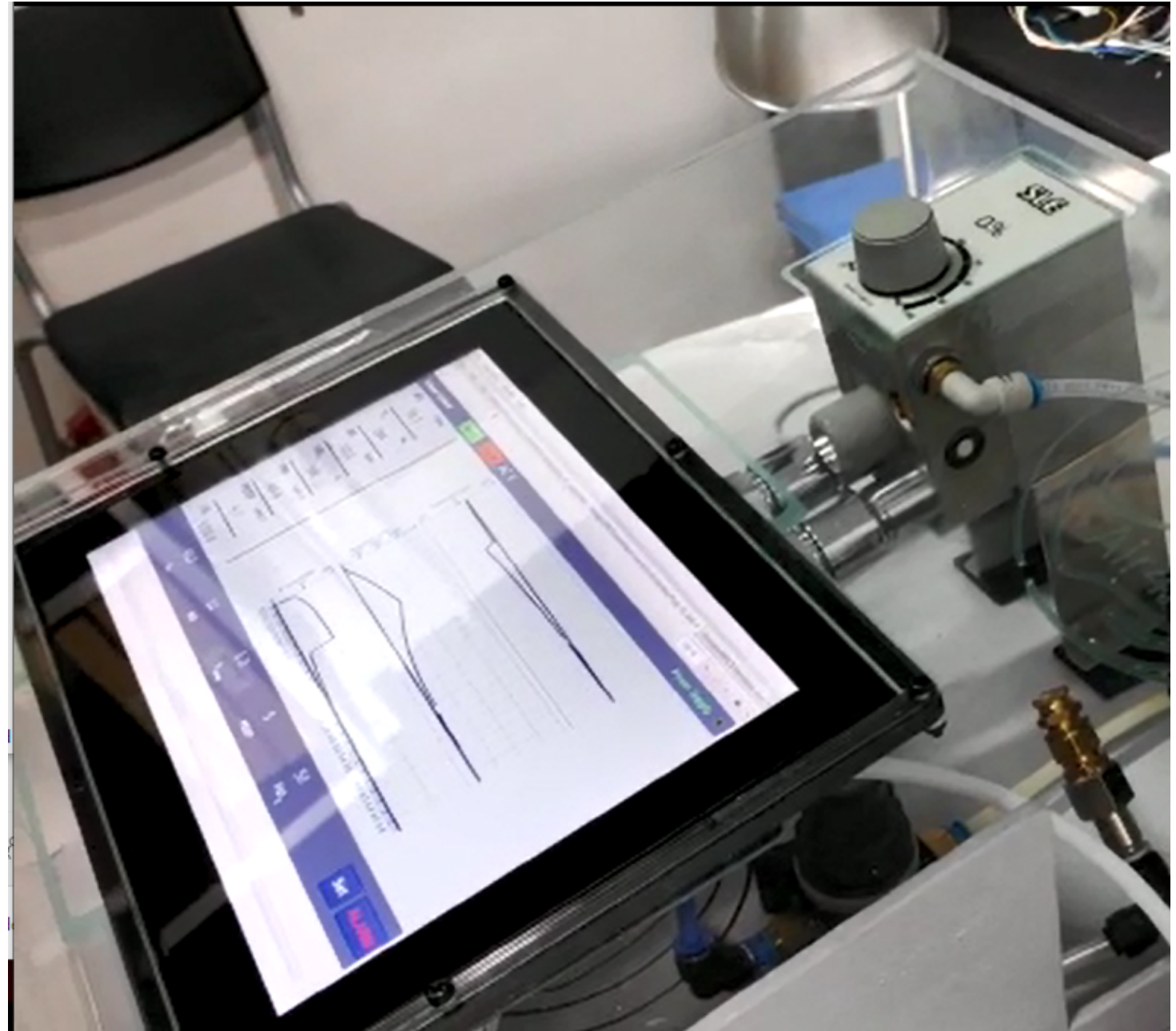
Phoebus is packaged for linux, windows, and mac OS



Supported added for raspberry pi



The java jre can also be packaged with the product



Useful Links

- Documentations and User Guide

<https://control-system-studio.readthedocs.io/en/latest/>

- Fork us on Github

<https://github.com/ControlSystemStudio/phoebus>

<https://github.com/ControlSystemStudio>