# EPICS Tools and Services

**Kunal Shroff – NSLS2**
**Kay Kasemir – SNS**
**Georg Weiss, Anders Harrisson, Fredrik Soderberg – ESS**
**Will Rodger, Rebecca Williams – DLS**
**Tynan Ford – ALS**
**Genie Jhang, Tanvi Ashwarya – FRIB**
**Jacqueline Garrahan – SLAC**
**Ralph Lange – ITER**
**Imran Usmani – ALS**

css
control system studio

# CS-Studio Collaboration

*17+ sites actively packing a site-specific CS-Studio products or Participating in the development of one or more of the EPICS services*

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

*12+ sites/labs/institutions using prepackaged products*

Additionally, many users who do not create their own products.

## Meet Our Team

**Eric Berryman**
Community Manager
Facility for Rare Isotope Beams (FRIB) at MSU

**Kay Kasemir**
Site Representative
Spallation Neutron Source (ORNL)

**Kunal Shroff**
Site Representative
National Synchrotron Light Source II (NSLSII) at BNL

**Will Rogers**
Site Representative
Diamond

**Nadine Utzel**
Site Representative
ITER

**Dominic Oram**
Site Representative
ISIS

**Charles-Henry Patard**
Site Representative
GANIL/Spiral2

**Joerg Penning**
Site Representative
DESY

**Yongxiang Qiu**
Site Representative
CSNS

**Xinyu Wu**
Site Representative
CSIRO

**Claudio Rosati**
Site Representative
European Spallation Source (ESS)

**Gustavo Ciotto Pinton**
Site Representative
Laboratório Nacional de Luz Síncrotron (LNLS)

**손창욱 (C.W. Son)**
Site Representative
Korean Heavy Ion Accelerator (RAON)

**Wesley Moore**
Site Representative
Jefferson Lab (JLab)

# EPICS Tools and Services

- EPICS java core:
  Consists of Channel Access and PVAccess client libraries, utility libraries

- EPICS middle layer Services:
  Archiver, Alarm, Save Restore, Channel Finder, Olog, …

- EPICS tools:
  CS-Studio & Phoebus

# Release 4.7

- EPICS core, services, and tools version 4.7.x was released on Aug 19th, 2022

- The release is published to maven central https://search.maven.org/search?q=org.phoebus

**Apache Maven**
maven.apache.org

```
<dependency>
  <groupId>org.phoebus</groupId>
  <artifactId>core-pv</artifactId>
  <version>4.7.0</version>
</dependency>
```

- Simplified and standardized release process*

  *mvn release:prepare*
  *mvn release:perform*

# EPICS Core: Channel Access (CAJ)

- Switch to GitHub Actions for CI

- Additional CAJ properties to configure channel access echo timeout & minimum search interval

- Improvements in error messages and logging

- Agreements on the roadmap for CAJ/JCA and CA support
  - Mostly bug fixes, emphasizing stability
  - New features will go into PVA

# EPICS Core: PVAccess

- PVA (core-pva)
  - IPv6 Support
  - EPICS_PVA_NAME_SERVERS for TCP-only name lookups

```
maven.apache.org

<dependency>
  <groupId>org.phoebus</groupId>
  <artifactId>core-pva</artifactId>
  <version>4.7.0</version>
</dependency>
```

- Prototype for NameServer using the core-pva PV Server lib
  - Listens to name searches via UDP or TCP, IPv4 or IPv6
  - Replies with TCP address & port of actual PVA server
  - For now, manual config, plan to eventually use e.g. Channel Finder

# EPICS Core: Type definitions

- Expanding EPICS VTypes
  - Support additional fields in the VImage meta data
    - x & y offset
    - reversed flag
  - Add "description" field to all VTypes, PVAccess clients receive description updates
  - Range's support expanded to allow cases where only part of the range limits are defined

# Epics services

- EPICS middle layer services
  - Reactive Services
  - Adoption of modern solutions and technologies ( e.g. springboot, kafka, elastic, mongoDB, ...)

- Services which have been redesigned/refactored
  - ChannelFinder
  - Olog
  - Alarm Services (Alarm Server, Alarm Message Logger, Alarm Configuration Manager)
  - Save Restore
  - Scan Engine
  - ...

- Standardize the release process
- Migration from elastic 6 → 8
  - Migration of data

# EPICS Services: Alarm logger

- Records all alarm messages (Alarm State changes, User actions, Automated actions, etc...)



Alarm
Message
Logger

# EPICS Services: Alarm logger

- Developed a REST service for the Alarm Logging Service
  - Optimization of Queries
  - Clients are unaffected with changes to backend
- Migrate from elastic 6 -> 8

REST Service API

Alarm Message Logger

elasticsearch
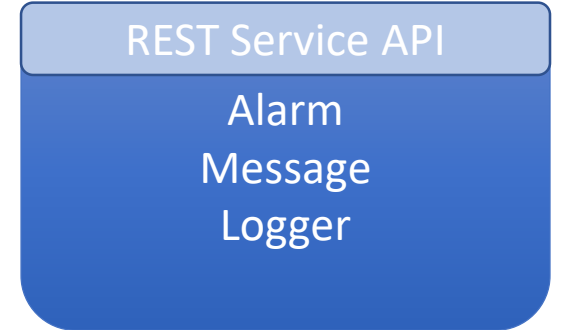
| Alarm Log Table ✕ | | | | | | | |
|---|---|---|---|---|---|---|---|
| < | Query: | pv=*&severity=*&message=*&current_severity=*&current_message=*&user=*&host=*&command=*&start=19 hours&end=12 hours | | | | | |

| Config | PV | Severity | Message | Time | Message Time | Current Severity | Current Message |
|---|---|---|---|---|---|---|---|
| state:/DTL/SKID/CWM-CWS0... | CWM-CWS04:WtrC-PT-025:... | UNDEFINED | Disconnected | 2022-09-15 01:01:24.638 | 2022-09-20 20:37:47.558 | MINOR | LOW_ALARM |
| state:/DTL/SKID/CWM-CWS0... | CWM-CWS04:WtrC-PT-025:... | UNDEFINED | Disconnected | 2022-09-15 01:01:24.638 | 2022-09-20 20:27:42.556 | OK | NO_ALARM |
| state:/DTL/SKID/CWM-CWS0... | CWM-CWS04:WtrC-PT-025:... | UNDEFINED | Disconnected | 2022-09-15 01:01:24.638 | 2022-09-20 20:26:59.556 | MINOR | LOW_ALARM |
| state:/DTL/SKID/CWM-CWS0... | CWM-CWS04:WtrC-PT-025:... | UNDEFINED | Disconnected | 2022-09-15 01:01:24.638 | 2022-09-20 20:16:54.555 | OK | NO_ALARM |
| state:/DTL/SKID/CWM-CWS0... | CWM-CWS04:WtrC-TT-402:... | UNDEFINED | Disconnected | 2022-09-15 01:01:24.637 | 2022-09-20 20:04:20.750 | MINOR | LOW_ALARM |
| state:/DTL/SKID/CWM-CWS0... | CWM-CWS04:WtrC-TT-402:... | UNDEFINED | Disconnected | 2022-09-15 01:01:24.637 | 2022-09-20 20:04:20.552 | OK | NO_ALARM |
| state:/DTL/SKID/CWM-CWS0... | CWM-CWS04:WtrC-PT-025:... | UNDEFINED | Disconnected | 2022-09-15 01:01:24.638 | 2022-09-20 18:18:06.536 | MINOR | LOW_ALARM |
| state:/DTL/SKID/CWM-CWS0... | CWM-CWS04:WtrC-PT-025:... | UNDEFINED | Disconnected | 2022-09-15 01:01:24.638 | 2022-09-20 18:08:01.536 | OK | NO_ALARM |
| state:/DTL/SKID/CWM-CWS0... | CWM-CWS04:WtrC-PT-025:... | UNDEFINED | Disconnected | 2022-09-15 01:01:24.638 | 2022-09-20 18:07:18.536 | MINOR | LOW_ALARM |
| state:/DTL/SKID/CWM-CWS0... | CWM-CWS04:WtrC-PT-025:... | UNDEFINED | Disconnected | 2022-09-15 01:01:24.638 | 2022-09-20 17:57:13.533 | OK | NO_ALARM |
| state:/DTL/SKID/CWM-CWS0... | CWM-CWS04:WtrC-TT-402:... | UNDEFINED | Disconnected | 2022-09-15 01:01:24.637 | 2022-09-20 17:21:33.929 | MINOR | LOW_ALARM |
| state:/DTL/SKID/CWM-CWS0... | CWM-CWS04:WtrC-TT-402:... | UNDEFINED | Disconnected | 2022-09-15 01:01:24.637 | 2022-09-20 17:21:33.524 | OK | NO_ALARM |

# EPICS Services: ChannelFinder

- Channel Finder improvements/maintenance
  - Publish "ENGINEER", "LOCATION" or configurable env. vars from IOC
  - Improve error reporting and add display errors to GUI tools
  - Refresh GUI when editing channel data
- Migrate from elastic 6 -> 8
- Ongoing effort to develop a NameServer using the core-pva PV Server lib, which uses the Channel Finder directory service

# EPICS Services: pvInfo

- pvInfo web project
  - Displays ChannelFinder information
  - Adds live data from PV web socket
  - Adds history data from Archive Appliance

- Check out "Phoebusgen & PV Info" talk

# EPICS Services: Save Restore

- Based on the MASAR Epics middle layer service
- These can be used to
    - create and manage save sets (aka configurations) and snapshots
    - retrieve and compare snapshots
    - restore settings from snapshots

- REST services using the SpringBoot framework

    java [options] -jar service-save-and-restore-.jar

- Documented the REST service API of the new Save Restore service
- Ongoing effort to migrated to a NoSQL backend with a simplified REST services API and data model

# EPICS tools

- CS-Studio ( eclipse based and Phoebus )
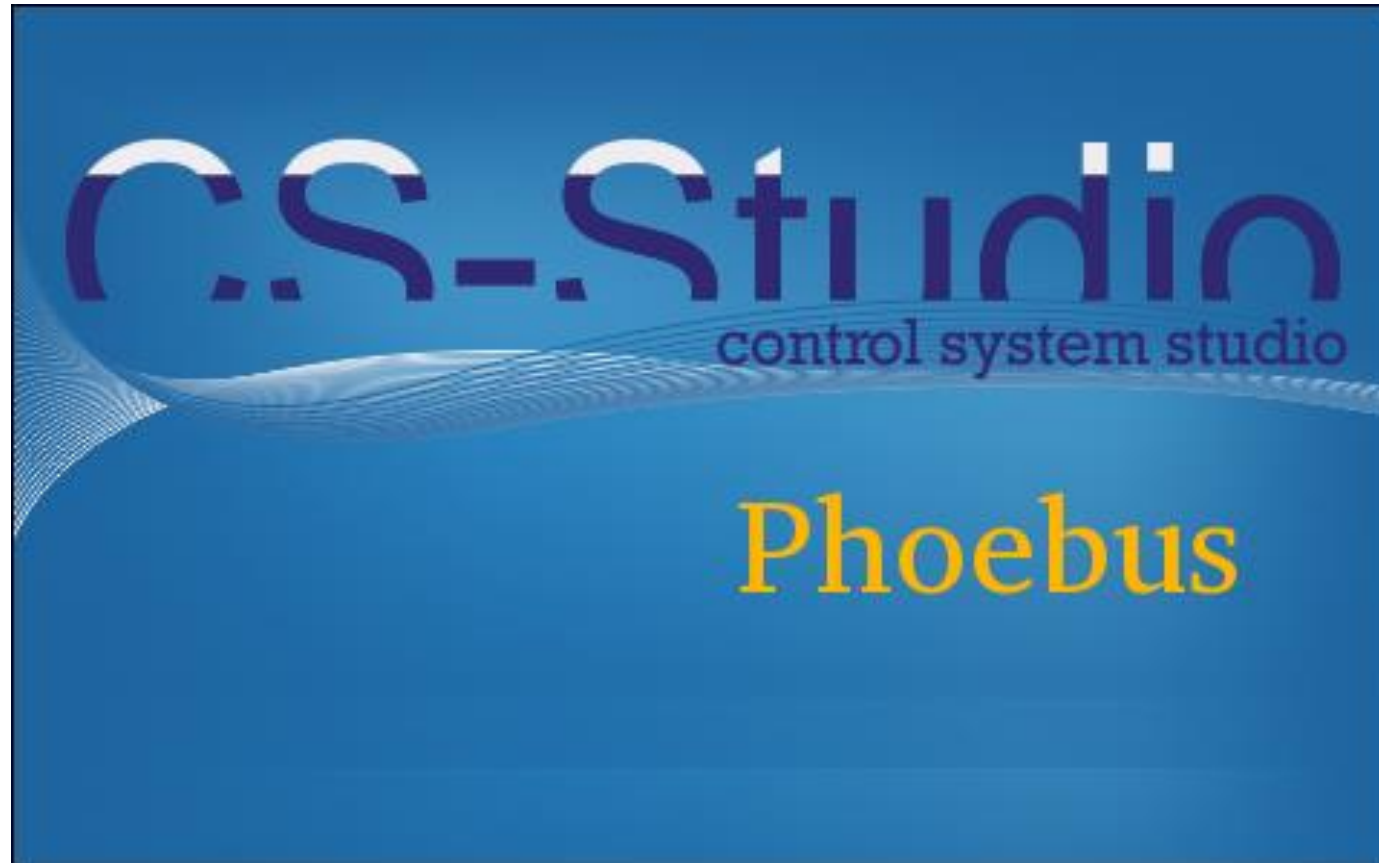
# Status of individual sites

| Original 32-bit "Eclipse RCP" | 64-bit "Eclipse RCP" | Latest "Phoebus" |
|---|---|---|
| Static, no longer supported, but otherwise runs fine | Bug fixes, long and awkward build | New features, bug fixes, easy development |
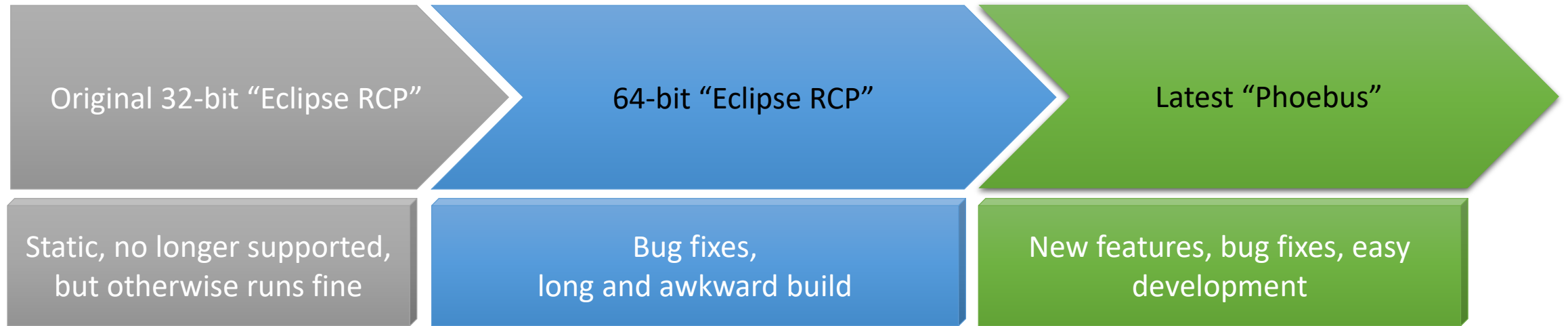
- SNS Accelerator

- DLS
- ITER
- ISIS
- FRIB (partially)
- NSLS-II (accelerator)
- …

- SNS Beam Lines
- ESS
- ALS
- FHI
- FRIB (partially)
- NSLS2 (some beamlines)
- …

# CS-Studio Collaboration Status (Phoebus)
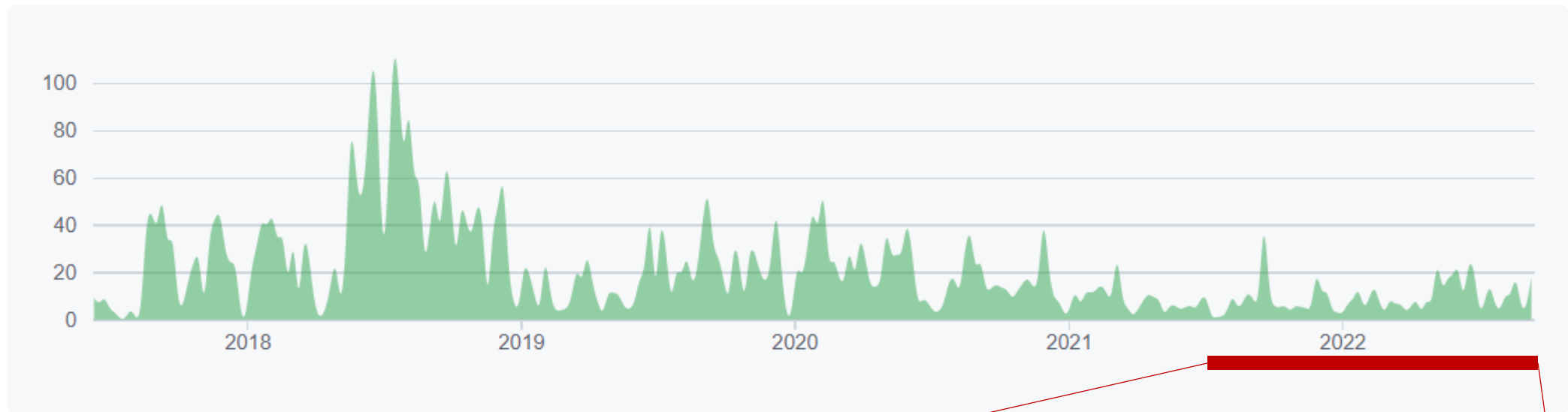
# CS-Studio Collaboration Status (Phoebus)

- 128 Issues closed 35 new issue still open

- 344 Closed PR's



## Community insights

### Contribution activity

Count of total contribution activity to Discussions, Issues, and PRs
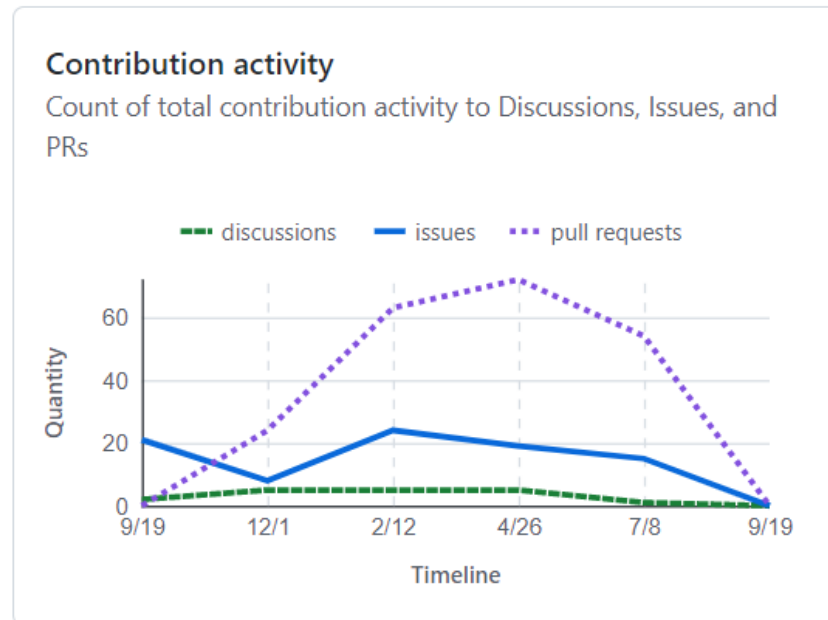


⊙ 91 Open   ✓ 604 Closed

☐  Author ▾    Label ▾    Projects ▾    Milestones ▾    Assignee ▾    Sort ▾

☐ ⊘ **closeAllTabsKeyCombination Breaks UI Tests**                                    💬 2
#2377 by lorenzo-gomez-windhover was closed 6 days ago

☐ ⊘ **CSSTUDIO-1338: ScaledSlider and Scrollbar Widgets Reflect**        ⇅ 1    💬 14
**Incorrect PV Value When Dragged Outside Limits**
#2376 by cjenkscybercom was closed 5 days ago

☐ ⊘ **inaccurate archived data for MySQL**                                          💬 4
#2368 by L-Roussel was closed 11 days ago

☐ ⊘ **Clean up existing selections**
#2360 by shroffk was closed 1 minute ago

☐ ⊘ **discussion - have complete settings.ini in target**                      💬 9
#2353 by tynanford was closed 3 days ago

☐ ⊘ **PV Table -> Right click -> Insert Row doesn't work with empty table**
#2348 by tynanford was closed on Aug 9

☐ ⊘ **XYPlot widget: Support "On Right" for value axes**                       💬 1
#2343 by kasemir was closed on Aug 5

☐ ⊘ **app-alarm-ui Automated Actions Gui enhancement suggestion**        💬 6
#2335 by katysaintin was closed on Jul 26

☐ ⊘ define a time interval for StripChart

# CS-Studio Collaboration Status (Eclipse)

- CS-Studio eclipse release 4.6
    - Upgraded to use eclipse 2020-12
    - Upgraded to build and run with JDK11
    - Will be supported till October 2024
    - Ongoing work to upgrade to JDK17 (should significantly extends the support deadline… but please consider migrating to CS-Studio Phoebus)

# DataBrowser Improvements

Show in the databrowser the events where the archiver appliance disconnected from a PV.

# Save Restore

# PVAccess

- Pvaccess supported by all applications ( probe, pvtree, alarm, display builder, … )

- *Use pva://… prefix to select PV Access*
- *Set default in phoebus settings.ini*
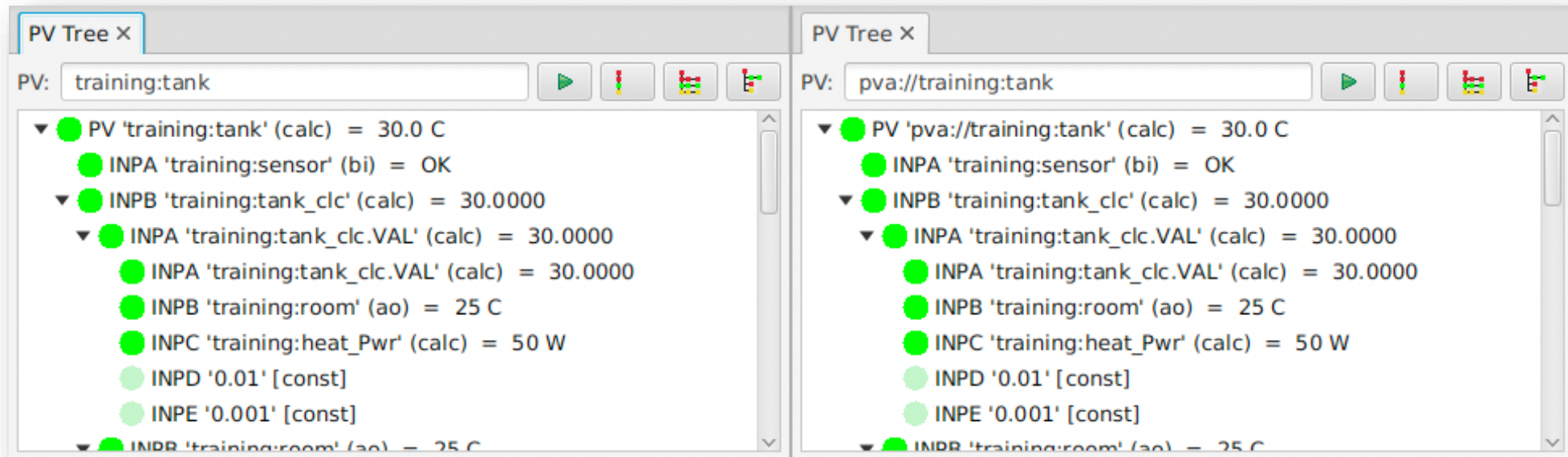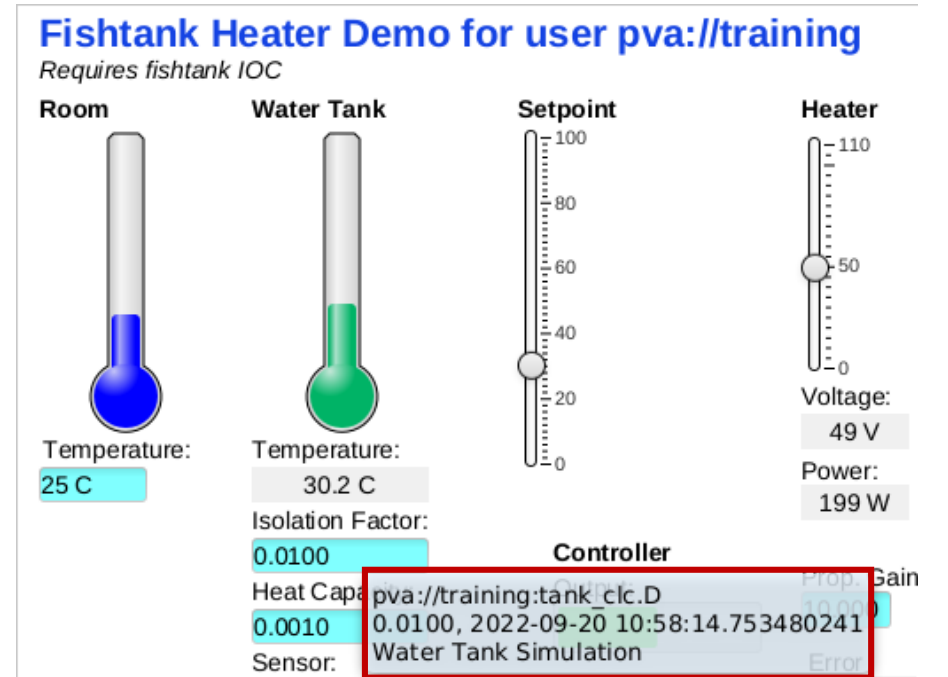
# PVAccess & VImage

*pva://my_ad_image*

- The Image MetaData and Image data are packaged together in the NTNDArray
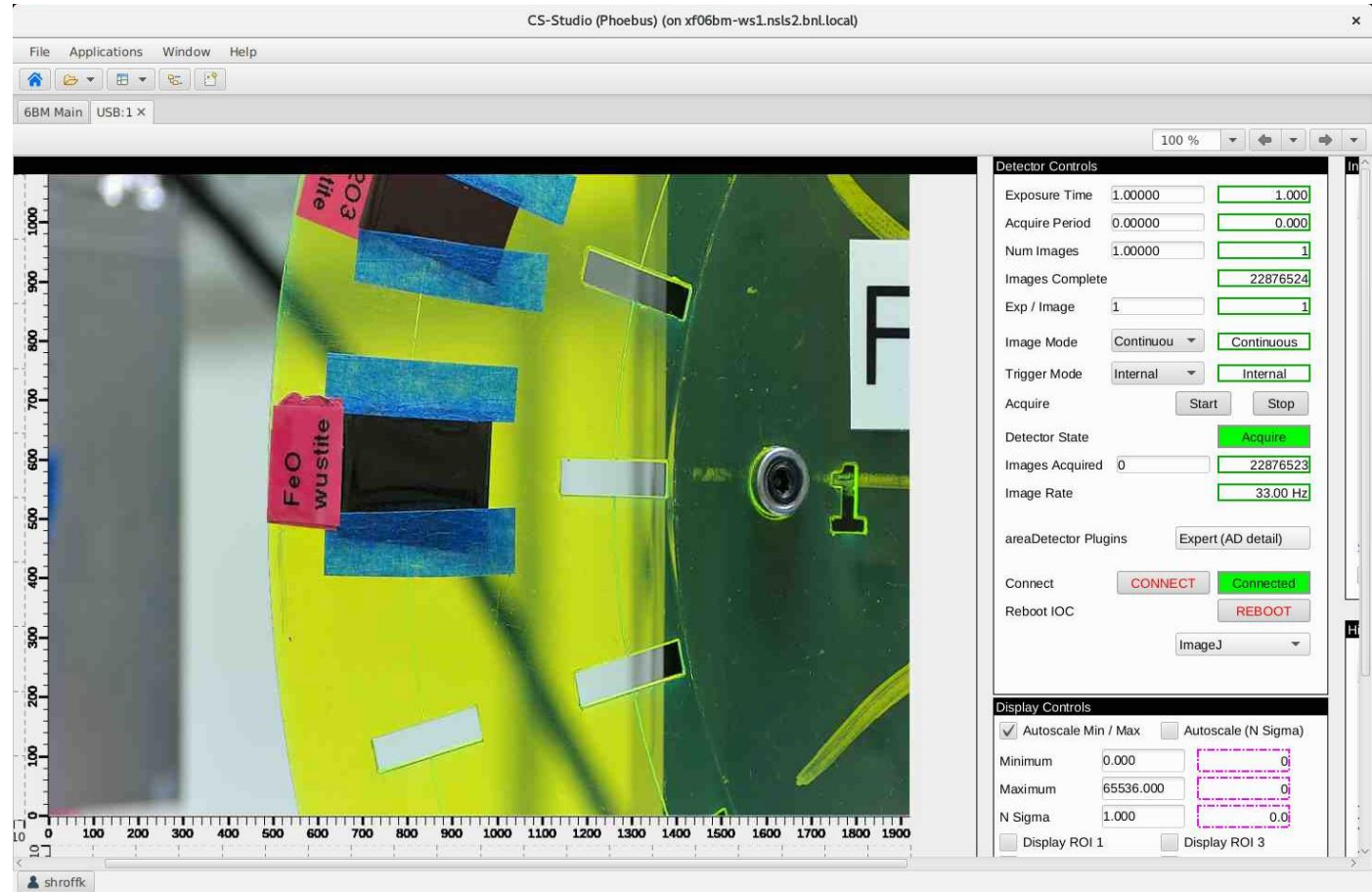
# PVAccess & VImage

*pva://my_ad_image*

Support for
- x & y offset
- reversed
- compressed



**Area Detector Demo (PVA)**

Detector    Plugins

1) cd /ics/examples/AreaDetector
   ./start_sim_ioc.sh
2) Open Detector page
3) Press Connect.. "Start"
4) Open Plugins.. "All" and "Enable" the NDPluginPVA

Start    Stop

Enable

```
0,62,60,58,56,54]
    codec_t codec
        string name lz4
        any parameters
            int  5
    long compressedSize 753
    long uncompressedSize 10000
    dimension_t[] dimension
        dimension_t
            int size 100
            int offset 0
            int fullSize 100
            int binning 1
            boolean reverse true
        dimension_t
            int size 100
```

# PVAccess

- Handling custom PVStructure

- Reference a field/subfield
  - pva://neutrons/pixel

- Reference elements of an array
  - pva://sine/signal[1]
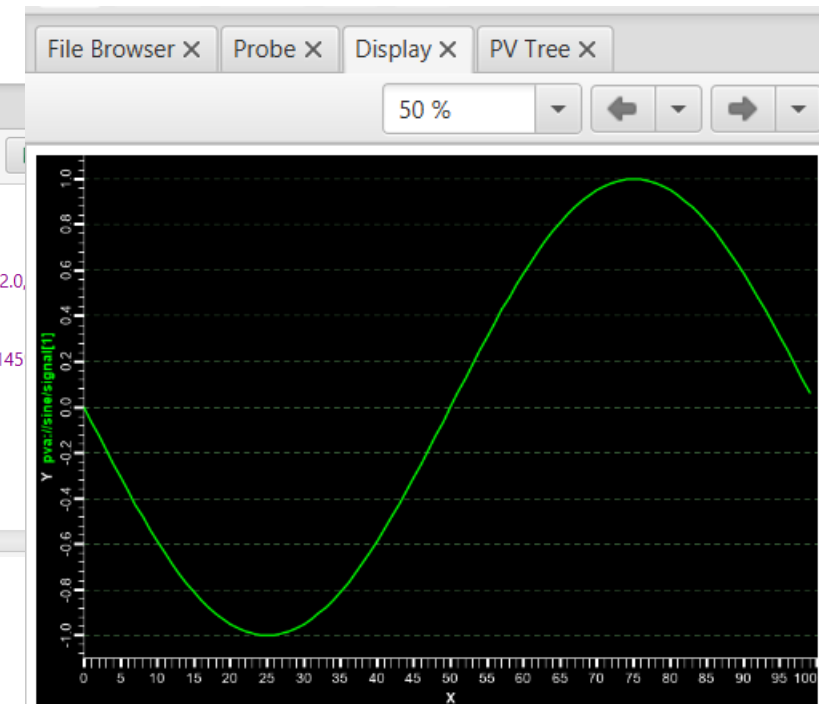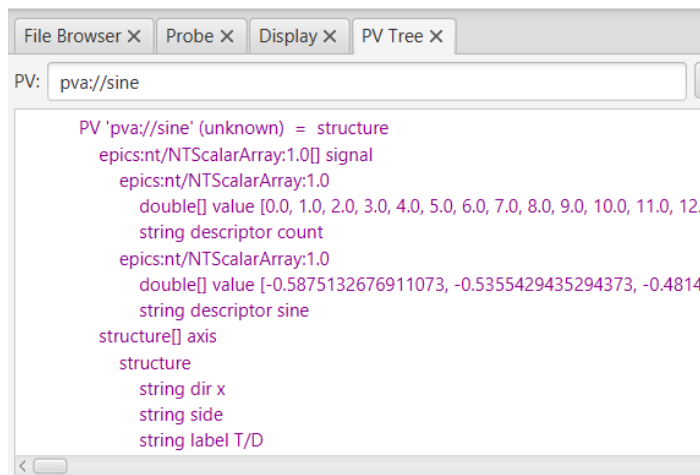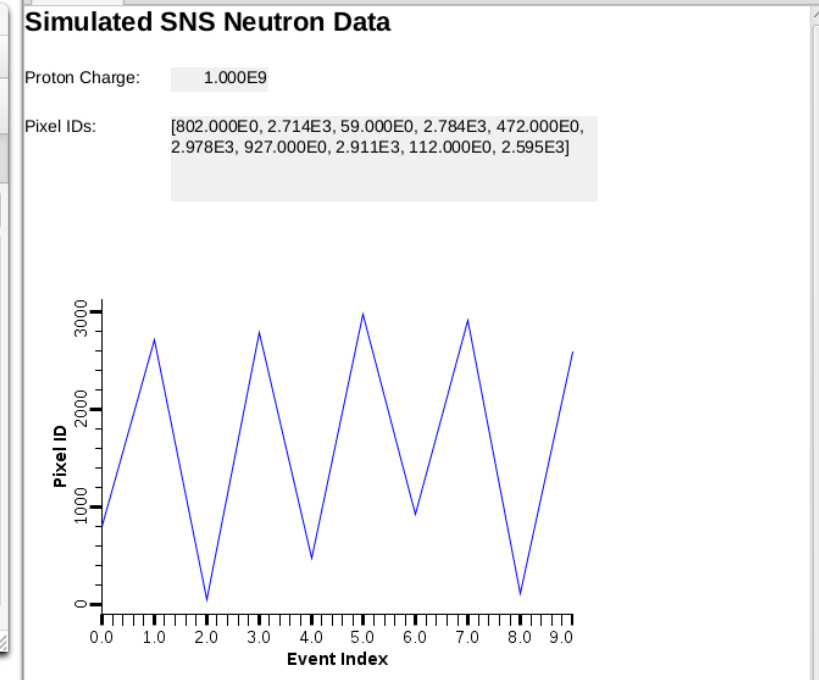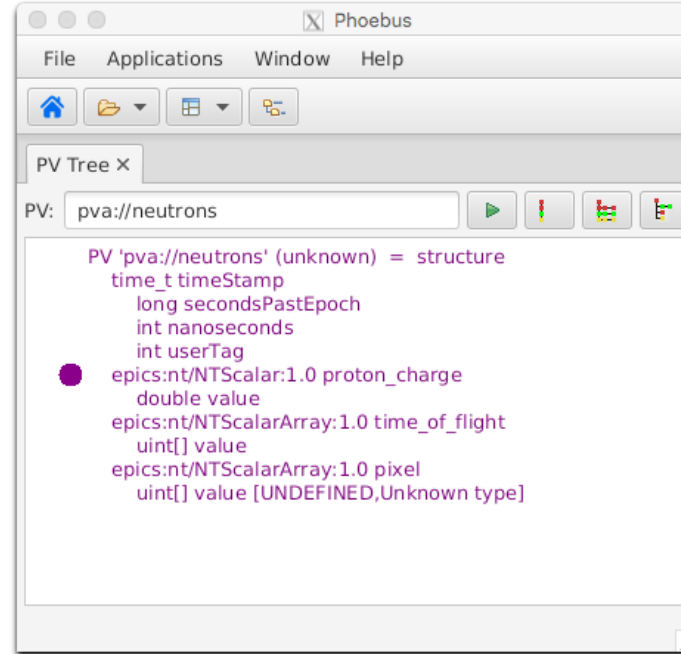
# Phoebus framework

- Framework 4.7 release
- Cleanup of Selection Services and Adapter Services
- Preferences framework
  - Severity Colors use preferences for local adjustments
- Additional Launch parameters
  - Phoebus launchers allows launching individual apps, resources, or combination of both
  - Launch layouts
  - Launch in a target window with specific dimensions and position

  *-resource 'file:/abs/path/file?app=display_runtime&MACRO=value&target=window@800x600'*

▷ org.phoebus.framework.adapter
▷ org.phoebus.framework.autocomplete
▷ org.phoebus.framework.jobs
▷ org.phoebus.framework.macros
▷ org.phoebus.framework.nls
▷ org.phoebus.framework.persistence
▷ org.phoebus.framework.preferences
▷ org.phoebus.framework.rdb
▷ org.phoebus.framework.selection
▷ org.phoebus.framework.spi
▷ org.phoebus.framework.util
▷ org.phoebus.framework.workbench

# Phoebus framework

- Core-security: ***SecureStore***
  Stores user credentials in an encrypted store

- Core-ui: ***Credentials Manager***
  User Interface to the Phoebus SecureStore to manage saved credentials

# Useful links

https://controlsystemstudio.org/
http://phoebus.org

- Fork us on github
  https://github.com/ControlSystemStudio

- ChannelFinder
  http://channelfinder.github.io/

- Olog
  https://github.com/Olog

- SaveRestore, Alarm Services, Scan Server
  https://github.com/ControlSystemStudio/phoebus/tree/master/services

# Developers meeting

- EPICS developers meeting in 24th to 28th Oct, 2022

  https://github.com/epics-base/epics-base/wiki/EPICS-Developers-Meeting-Oct,-2022


- Session
  - EPICS tools and services
  - EPICS base
  - EPICS build and deployment