



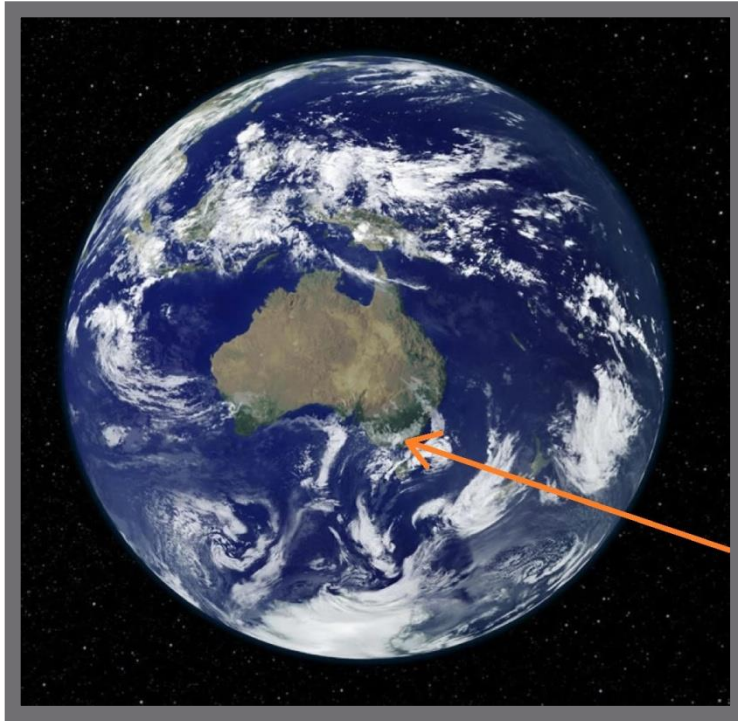
**Australian  
Synchrotron**  
Turning bright ideas into brilliant outcomes



# EPICS Qt Update

Paul Martin

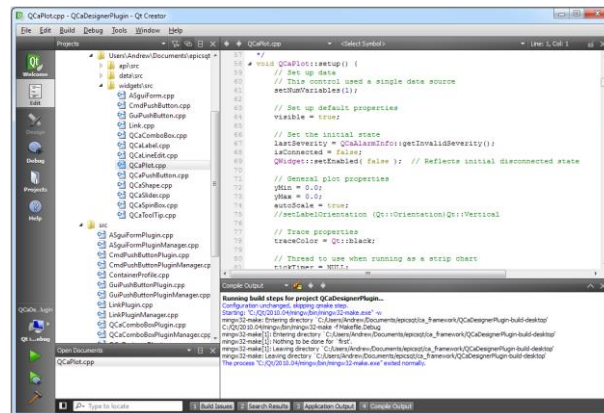
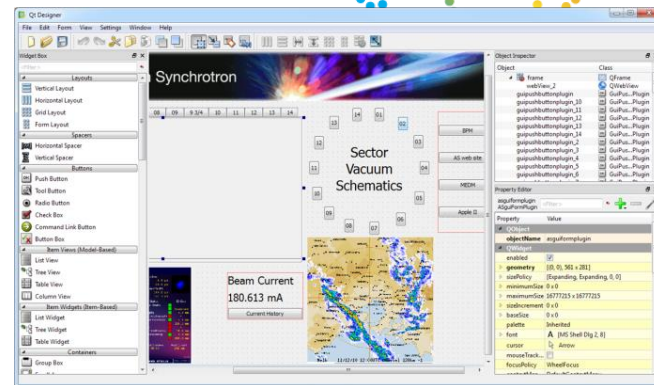
# Australian Synchrotron



- 3GeV, 216m circumference synchrotron
- 8 Beamlines
- 12 Software Engineers
- IMBL – Worlds Widest Beam - MRT Clinical Program – Safety Critical
- Melbourne, Australia
- Nearest other facilities: Taiwan, Thailand, Japan
- 16th Most Urbanized Country
- World's most livable cities
- Hosting ICALEPCS in 2015

- **Qt** is a cross-platform application and UI framework for developers using C++ – Windows, OS X, Linux, Embedded Linux, Android, iOS, vxWorks, Win CE, Amiga OS
- Open Source (LGPL v2.1)
- Trolltech -> Nokia -> Digia,
- Development tools: Qt Creator, Qt Designer, Qmake, Qt Linguist, Qt Assistant, Integration into Visual Studio
- Rich set of Widgets and other classes (1000+), Qwt (125+)
- Very Good Documentation, help, examples
- All Qt Objects contain powerful object communication mechanism (Signal+Slots)
- GUI Layout widgets
- Qt Project: [www.qt-project.org](http://www.qt-project.org)

## Qt Designer



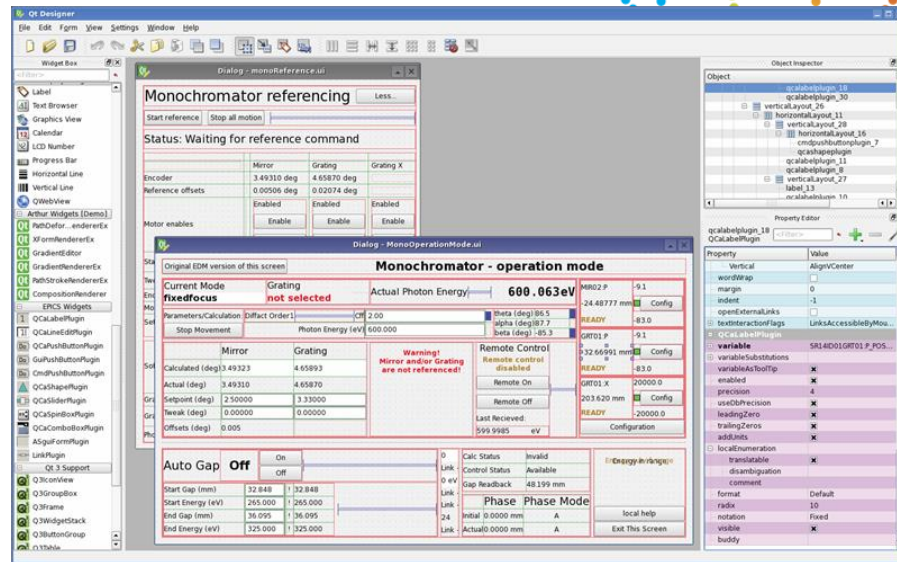
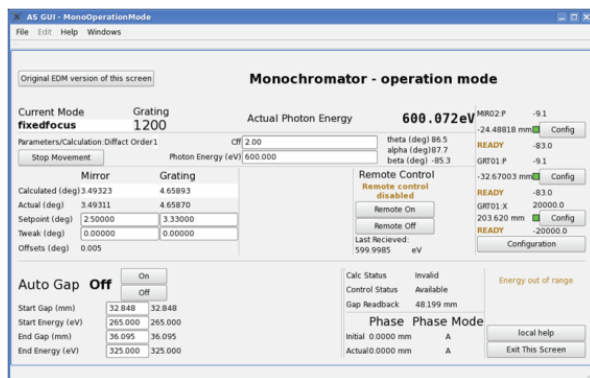
## Qt Creator

# EPICS Qt – Team

- Started 2009 – Anthony Owen, Andrew Rhyder, Glenn Jackson
- Joined 2011 – Andy Starritt
- Joined 2012 – Ricardo Fernandez
- Joined 2013 – Zai Wang (1 year contract)

# EPICS Qt – Rapid GUI Development

- Adds Channel Access to standard Qt Widgets and Data Classes
- Rapid GUI Dev – Drag and Drop EPICS aware components in Qt Designer
- Macro Substitutions for PV names and other GUI functions

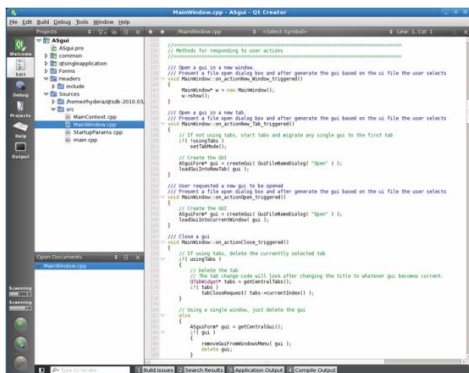


Qt Designer

Channel Access running at design time

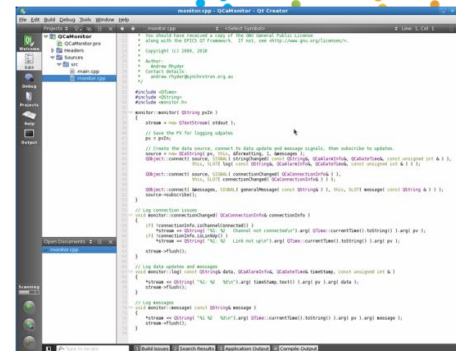
.ui file – presented using QGui on any platform (windows / linux)

# EPICS Qt – Other App Types

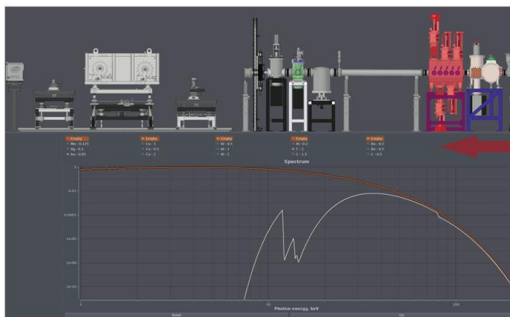


Qt Creator

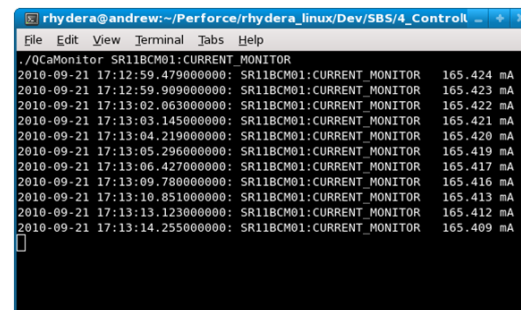
QCaString  
QCaInteger  
QCaFloating  
QCaByteArray



Code Rich  
Apps



Console  
Apps



Apps for mobile platforms ?

# EPICS Qt – Core Widgets



One of each

**QEAnalogProgressBar**

**QEBitStatus**

**Radion Buttons**

10  
 11  
 12

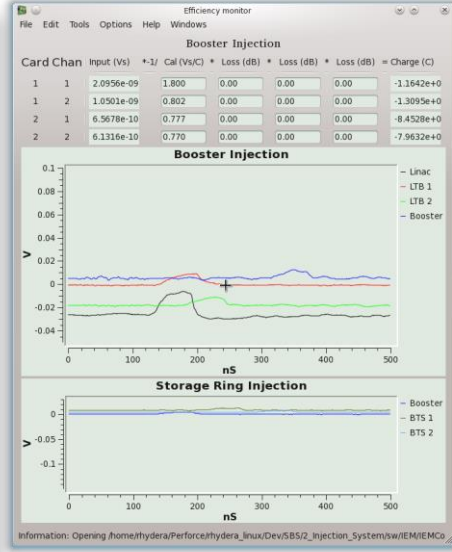
**Push Buttons**

10 on press    20 on release  
30 on click    Press, Release, Click

**Other**

QELabel: 13  
QESpinBox: 13  
QEComboBox: Medium speed  
QESlider: [Slider]  
QELineEdit: 13

Information: Opening /home/rhydera/oneOfEachPaul.ui



Plot

Shape

Stored Beam

Size and position

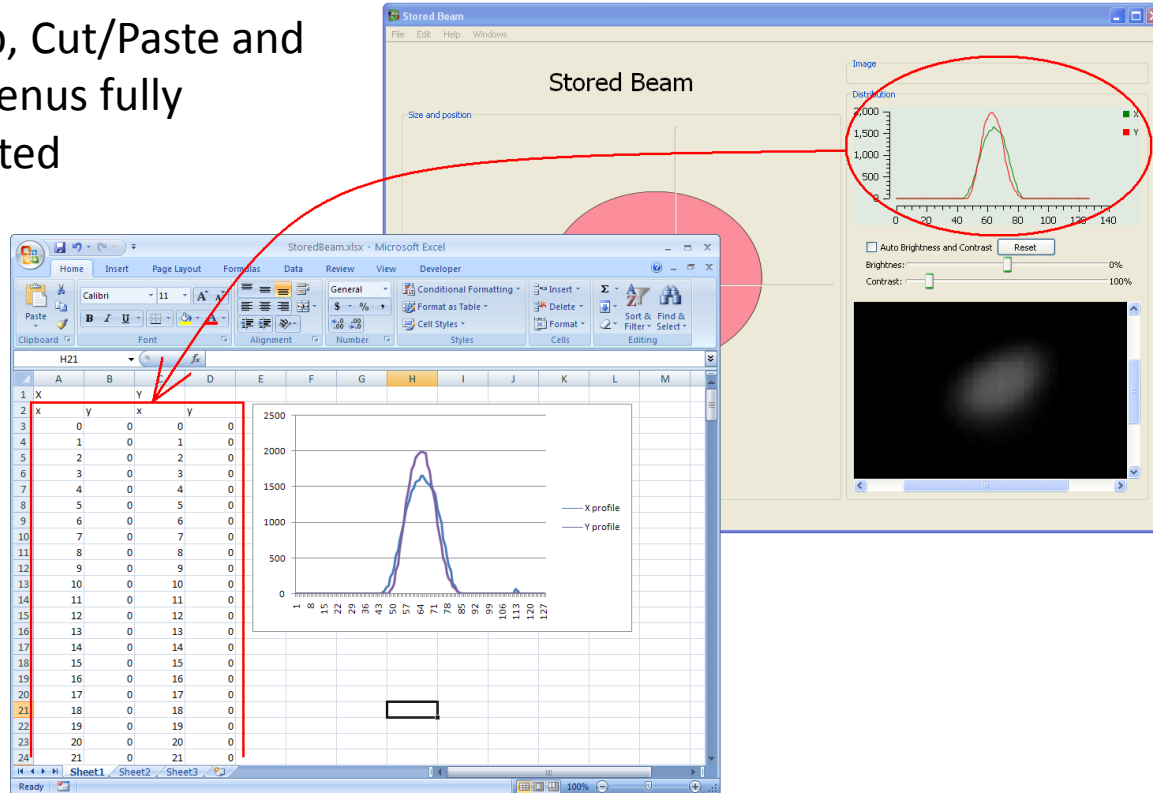
Offset: -5.9 um  
Size: 224.9 um

Beam Current: 186.479 mA

Offset: -24.4 um  
Size: 337.3 um

# EPICS Qt – Improvement – Drag/Drop

Drag/Drop, Cut/Paste and context menus fully implemented





# EPICS Qt – New Widgets - pvProperties

The image shows two overlapping windows from the EPICS Qt interface. The background window is titled "SXR Imaging Main" and displays a beamline diagram with various components like WBS, M1, and Mono. A red circle highlights the "Ring Current" value of 200.191 mA. The foreground window is titled "PV Properties <2>" and shows the configuration for the "SR11BCM01:CURRENT\_MONITOR" PV. A red arrow points from the highlighted value in the main window to the PV name in the properties window.

**SXR Imaging Main**

Ring Current: 200.191 mA

Undulator Gap: 24.512 mm

FE width (mm): 4.00 height (mm): 4.00

PSH width (mm): 4.00 height (mm): 4.00

Photon Energy: 324.689 eV

Settle (s): 0.1

WBS M1 Mono

7.7e-10 mbar 0.0e+00 mbar 4.7e-10 mbar 8.7e-10 mbar

Beamline available  
Shutters enabled

IOC Diagnostics Motor Scan  
EPS Photon Scan  
Pressure Plot

**PV Properties <2>**

NAME: SR11BCM01:CURRENT\_MONITOR

VAL: 200.190579 mA

HOST: 10.6.19.82:5064

TIME: 2013-10-04 12:46:55.000016294 EST

DBF: DBF\_DOUBLE INDEX: 1 / 1

Field	Value
RTYP	calc
NAME	SR11BCM01:CURRENT_MONITOR
DESC	BCM Smooth Current
ASG	
SCAN	Passive
PINI	NO
PHAS	0
EVNT	0
TSE	0
TSEL	
DISV	1
DISA	0
SDIS	
DISP	0
PROC	0
STAT	NO_ALARM
SEVR	NO_ALARM
NSTA	NO_ALARM
NSEV	NO_ALARM
ACKS	NO_ALARM
ACKT	YES
DISS	NO_ALARM
LCNT	0
PACT	0
PUTF	0
RPRO	0
PRIO	HIGH
TPRO	0
UDF	0
FLNK	SR11BCM01:STORED_BEAM_CALC
VAL	200.190578663
CALC	A
INPA	SR11BCM01:CURRENT_COMPRESS NPP MS

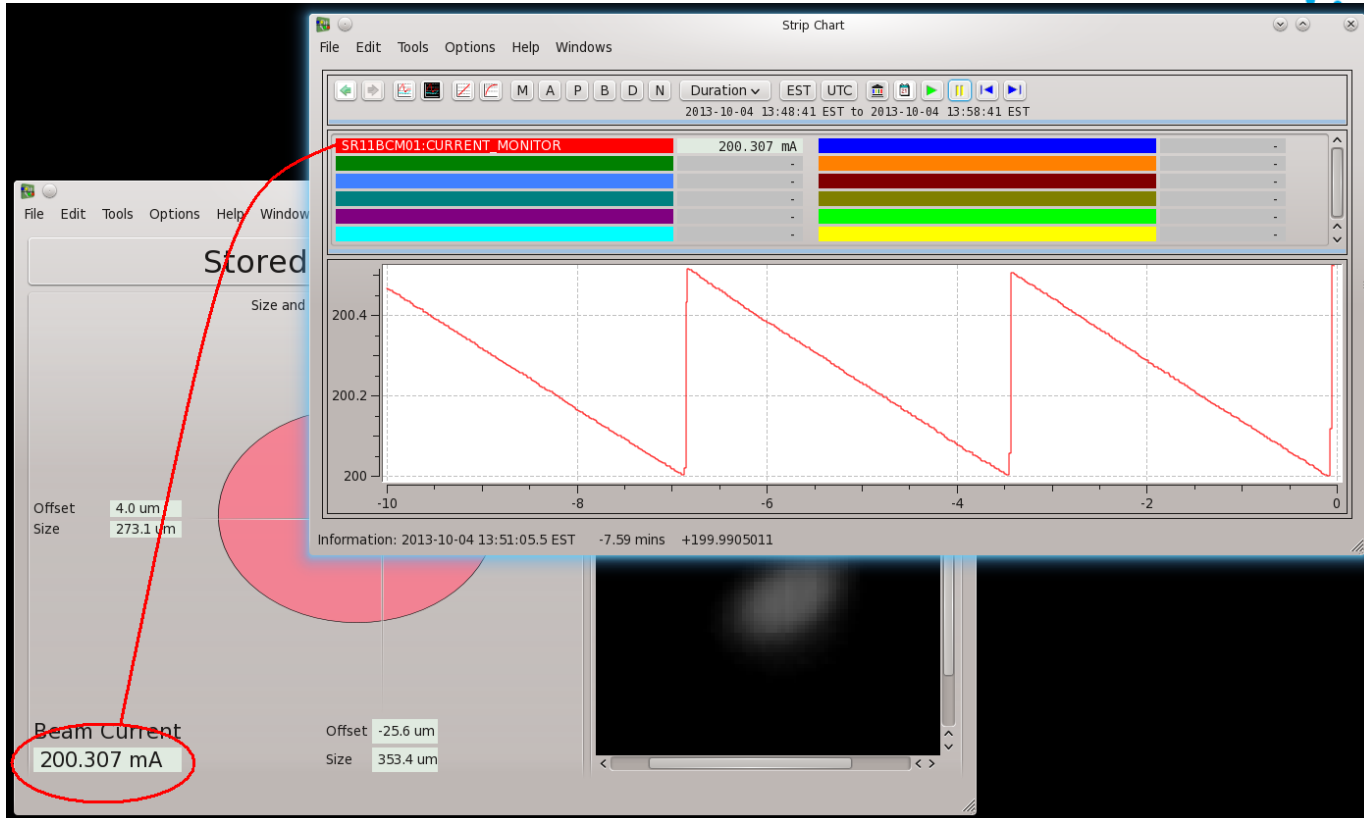
# EPICS Qt – New Widgets – Scratch Pad

The image displays three overlapping windows from the EPICS Qt interface:

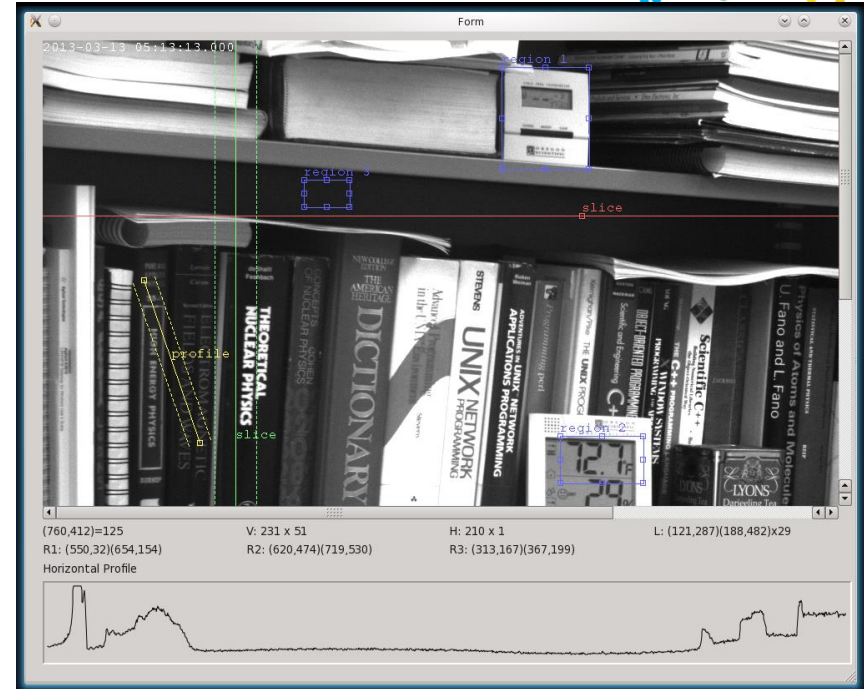
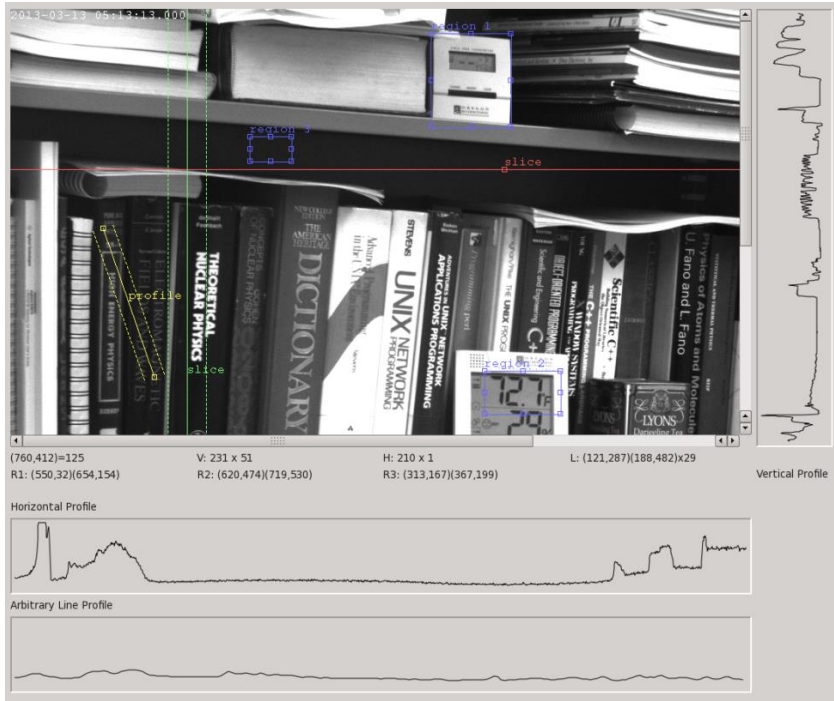
- Soft X-ray Imaging Main Panel:** Shows the Ring Current at 200.313 mA and Undulator Gap at 24.512 mm. A schematic diagram of the beamline includes components like FE, WBS, M1, PSH, Mono, and BCA. Pressure values are shown as 7.7e-10 mbar, 0.0e+00 mbar, 4.7e-10 mbar, 8.7e-10 mbar, and 6.5e-10 mbar.
- Scratch Pad:** A table listing PV names and their values:

PV Name	Description	Value
SR14ID01:GAP_MONITOR	Gap monitor wrapper	24.512 mm
SR14ID01GAUGCTRL2:PRESSURE2	Read Pressure Ch2	4.7e-10 mbar
SR14ID01MIR02:P_ENC_MONITOR	Read RON position	6.98202 deg
- Mono Operation:** Shows EPU configuration with Autogap enabled, Harmonic range (1st: 90 eV to 900, 3rd: 900 eV to 2000, 5th: 2000 eV to 3000 eV), and Mode set to C: Linear increasing. The Mirror angle is 6.98202 degrees.

# EPICS Qt – New Widget - Strip Chart



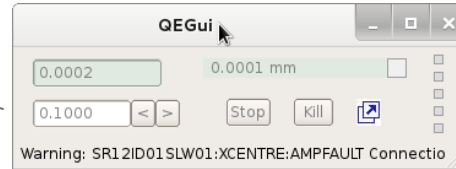
# EPICS Qt – Under Improvement - Image



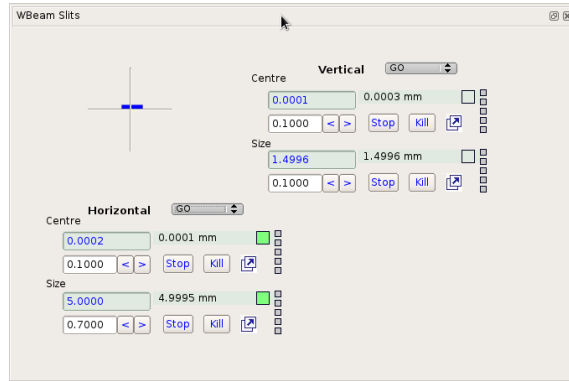
Current Development – Improved Area Detector Integration

# Current Development – Reusable components

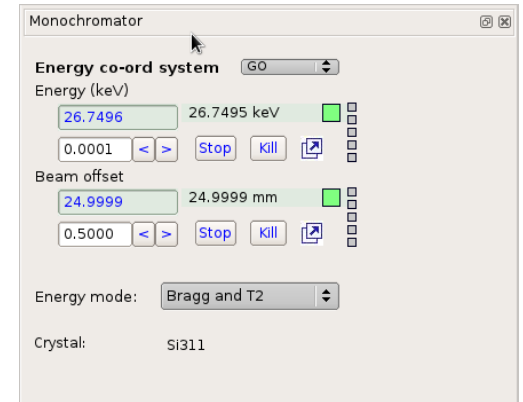
## Reusable component for Motor Record



Embedded in forms



Slits

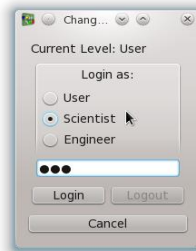
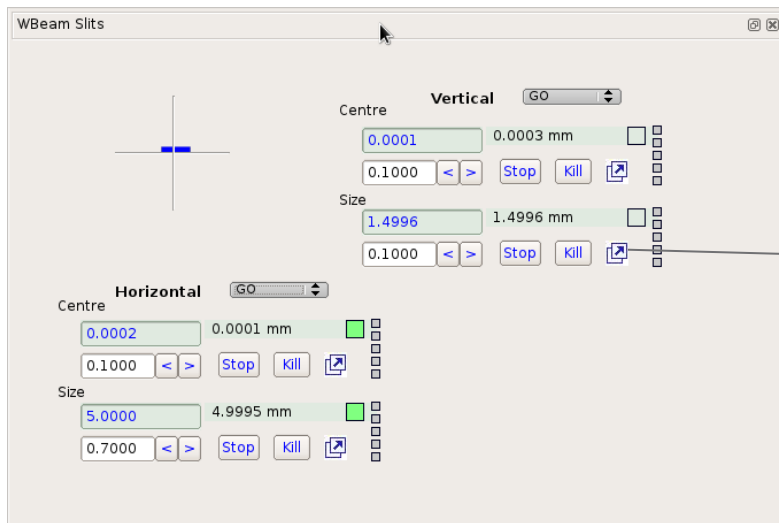


Mono

- Set MACRO for instance
- Consistency
- Build set of common components for Beamlines (eg Picoammeter)

# New Functionality - User Level

Logged in as User



Logged in as Scientist



# New Functionality - User Level

Logged in as Scientist

The screenshot shows the QEGui interface for a Scientist user. The main window is titled "QEGui". It features a "Operation" section with a text input field containing "26.7496" and "26.7495 keV", and buttons for "Sync", "Stop", and "Kill". Below this are fields for "Raw motor position", "Raw encoder position", "Following error", and "Max following error", all showing "267495" or "0.0000". A "Reset" button is next to the "Max following error" field. To the right, there are checkboxes for "Low limit", "Limit violation", "High limit", "Encoder loss", and "Amp fault", with a "Reset" button. A "User configuration" section includes "Velocity" (0.0500), "Homed" (checkbox), "User direction" (Positive/Negative), "User high limit" (42.0000 keV), "User low limit" (4.5000 keV), "User offset" (0.0000 keV), and "Home" buttons. At the bottom, there are "Open Plot..." and "More..." buttons. A warning message at the bottom reads: "Warning: SR12ID01DCM01:ENERGY.SET Connection down [Source QCaObject::process]".

More...

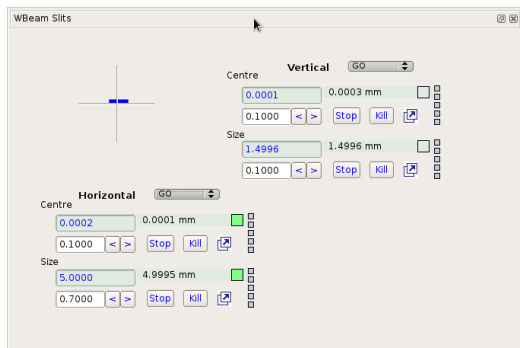
Logged in as Engineer

The screenshot shows the SR12ID01DCM01:ENERGY interface for an Engineer user. The main window is titled "SR12ID01DCM01:ENERGY". It features a "Operation" section with a text input field containing "26.7496" and "26.7495 keV", and buttons for "Sync", "Stop", and "Kill". Below this are fields for "Raw motor position", "Raw encoder position", "Following error", and "Max following error", all showing "267495" or "0.0000". A "Reset" button is next to the "Max following error" field. To the right, there are checkboxes for "Low limit", "Limit violation", "High limit", "Encoder loss", and "Amp fault", with a "Reset" button. A "User configuration" section includes "Velocity" (0.0500), "Homed" (checkbox), "User direction" (Positive/Negative), "User high limit" (42.0000 keV), "User low limit" (4.5000 keV), "User offset" (0.0000 keV), and "Home" buttons. A "Setup" section includes "Desired value" (26.7496), "Dial Units" (4.5000), "Engineering units" (keV), "Step size" (0.00010000 keV), "Encoder step size" (0.00010000 keV), "Move fraction" (1.0000 keV), "Maximum velocity" (0.1000 keV/sec), "Time to velocity" (0.2500 sec), "Settle time" (0.0000 sec), and "Backlash accel" (0.1000 sec). A "Status" section includes "Moving", "Ran out of retries", and a "Direction" indicator. An "Engineering configuration" section includes "Retry mode" (Default), "Max retries" (0), "Sync positions" (Synchronize), "Use encoder if present (EPICS closed-loop)" (No), "New target monitor" (No), "New target monitor deadband factor" (2), "Output specification" (@asynIMCS13CS2.6I), and "Precision" (4). At the bottom, there are "Open Plot..." and "More..." buttons. A warning message at the bottom reads: "Warning: SR12ID01DCM01:ENERGY.SET Connection down [Source QCaObject::process]".

# New Functionality - User Level

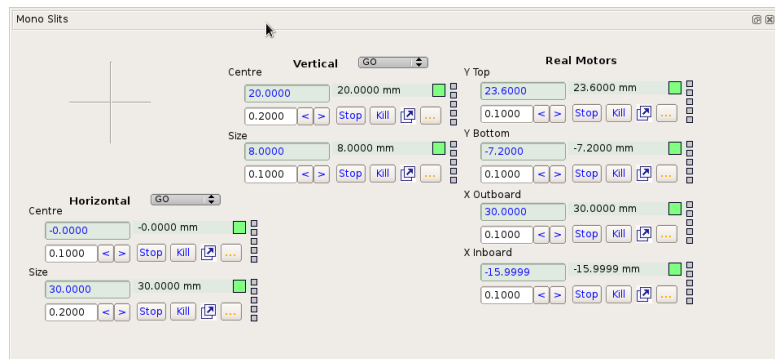


Log in as User



Virtual Motors

Log in as Scientist/Engineer



Real Motors

Same .ui file



# New Functionality – Save Configuration

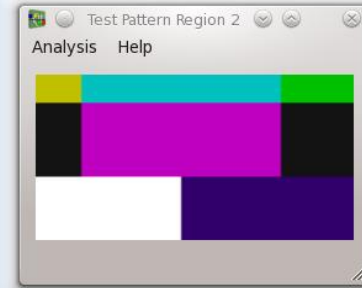
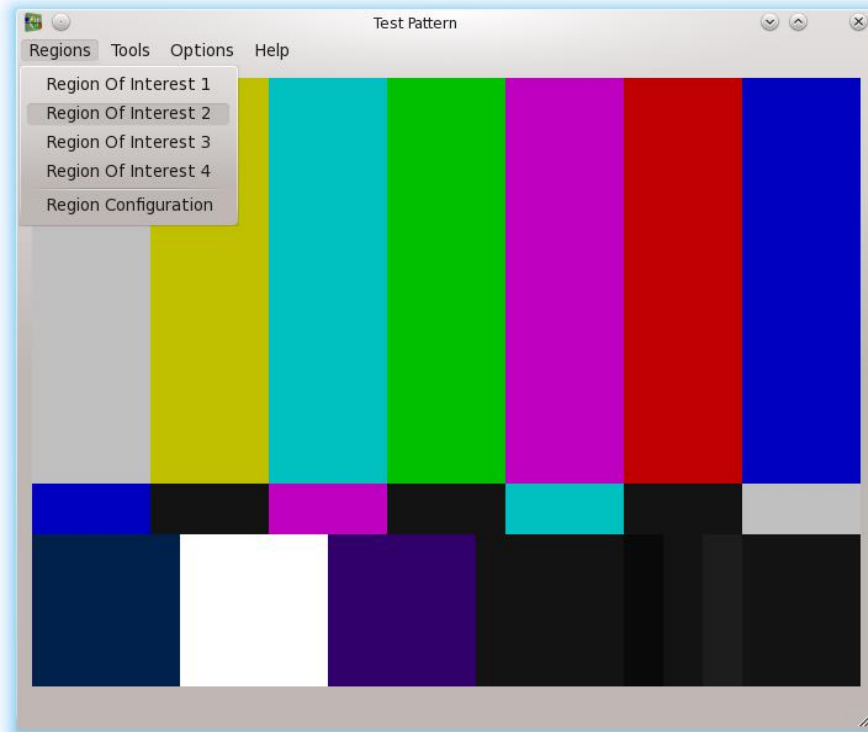
## Save Configuration

The screenshot shows the main control interface for the X-Ray Beamline Control System. At the top, there are menu options: Application, View, Tools, User Level, Save Configuration, and Restore Configuration. Below this, a grid of status indicators shows components like White Beam Slits, Filter Rack, Mirror 1, Steering Mask, DCM, Mono Slits, BPM, Mirror 2, and Mirror 3, all with 'OK' status. A Ring Current of 0.014 mA is displayed, along with buttons for 'Beam camera...', 'BLEPS...', 'SEPS...', 'FE Shutter', and 'Stop all motors'. The bottom section features an 'Overview' diagram of the beamline layout with various components labeled (FE, FR01, SLW01, MIR01, MSK02, DCM01, SLM01, BPM01, MIR02) and their respective parameters such as Energy (26.750 keV), Bragg (8.136 deg), V Size (8.000 mm), Diode (21.100 mm), Y (8.601 mm), H Size (5.000 mm), X (38.000 mm), X (77.000 mm), Y (9.800 mm), Roll (-0.487 V), and Pitch (-0.586 V). A warning message is visible at the bottom: 'Warning: SR12D01BPM01:FOILS:select Connection down [Source QCaObject::processEvent()]'.

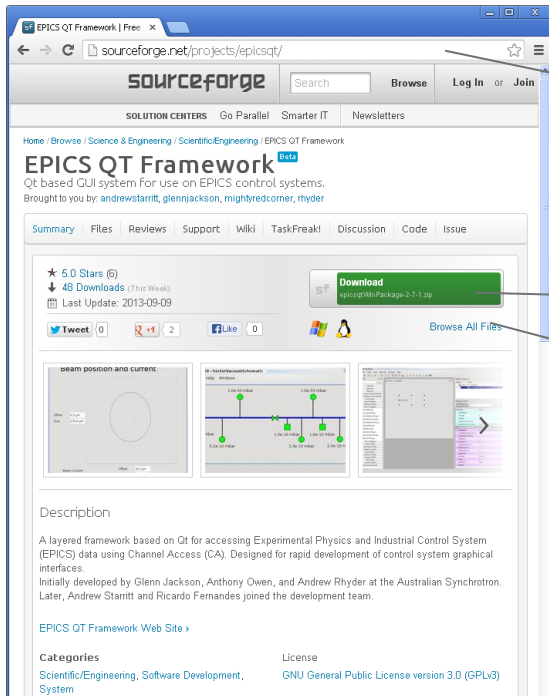
This screenshot illustrates the 'Save Configuration' functionality by showing the main interface window alongside several dockable forms. The 'WBeam Slits' form is docked on the right, displaying parameters for Centre (Vertical: 0.0001 mm, Horizontal: 0.0002 mm) and Size (Vertical: 1.4998 mm, Horizontal: 5.5000 mm). The 'Mono Slits' form is docked below it, showing Centre (Vertical: 20.0000 mm, Horizontal: -0.0000 mm) and Size (Vertical: 8.0000 mm, Horizontal: 30.0000 mm). The main window's 'Save Configuration' button is highlighted with a red arrow, and the dockable forms are shown as separate windows that can be moved and docked.

Now supports dockable forms!

# Under Development – Menu Customization



# EPICS Qt – Website



<http://sourceforge.net/projects/epicsqt/>

Easy Installation

Documentation

Contact [andrew.rhyder@synchrotron.org.au](mailto:andrew.rhyder@synchrotron.org.au)

See you in Melbourne - 2015