



# EPICS Qt

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**EPICS** Fall Meeting October 2014 Saclay



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**2015**  
**ICALEPCS**  
melbourne • australia



18-25th October 2015  
Melbourne Convention & Exhibition Centre

# Presentation Summary

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- Qt Intro
- Qt Within the EPICS community
- Qt Update

# What is Qt



- Qt is a cross-platform application and UI framework for developers using C++.
- It can be used under an open source licence.
- Qt has had a good track record of ongoing development and expanding use.
- Strong community based governance.



DEVELOPER  
DAYS 2014  
EUROPE  
Berlin, Oct 6-8



DEVELOPER  
DAYS 2014  
NORTH AMERICA  
San Francisco, Nov 3-5

# Qt is an ecosystem



- An active open source community supporting documentation, forums, and tools
- Any applications we produce come with a lot of support from that community.

The collage features several key elements: a Qt Creator IDE window showing code for a Qt widget; a Qt Project Downloads page with a list of widget types like Vertical Layout and Horizontal Layout; a Qt logo; a book cover for 'Python with Qt Edition'; and a smartphone displaying a 'Cooling System Data' application with a gauge showing 67°C and various charts.

**Introducing Qt 5.2**  
True cross-platform framework  
for desktop, embedded and mobile

**Qt forums**

Welcome to the Qt-Project.org  
at the rules we wrote down to



# Qt roadmap



- Traditional desktop
- Embedded systems
- RTOS (including VxWorks)
- Touch screens
- Mobile platforms



# Can we benefit from Qt?



SWISS SYNCHROTRON

The image displays a complex software environment for the SwissFEL Injector Test Facility. The main window, titled "SwissFEL Injector Test Facility", shows a detailed schematic of the X-band installation with various components like FINS1-FINS4, FINXB, F10D1, and F10D10. It includes a "Shutdown (X-band installation)" section and a "Last 1h" plot. A "Laser" control panel shows parameters like "Mode: On", "Wavelength: 99999 fs", and "X-110 Unlocked". The "HF Status" section provides a table of operational parameters for various stations:

Station	Interlock	Modulator HV	Modulator	Phase
FINSS	Interlock: [red]	Modulator HV: [green]	Modulator: [green]	45.12 deg
FINSB01	Interlock: [red]	Modulator HV: [red]	Modulator: [red]	2.98 deg
FINSB02	Interlock: [red]	Modulator HV: [red]	Modulator: [red]	48.96 deg
FINSB03	Interlock: [red]	Modulator HV: [red]	Modulator: [red]	102.05 deg
FINXB	Interlock: [red]	Modulator HV: [red]	Modulator: [red]	-
F10D1	Interlock: [red]	Modulator HV: [red]	Modulator: [red]	-66.46 deg

Other visible windows include "Check Beam Status" (showing 210.055581 mA and 1.90 T), "Synchronized Dwelltime Controls" (with Sync Status Enabled and Dwell Time 1000), "XAFS Data Collection", and "MPO Stream" showing a beam profile. A "PSA" (Pressure Safety Area) status panel shows doors as North OPEN, West OPEN, and South OPEN. A "History" window on the left lists run events and their durations. A "Spectrum" window at the bottom shows a plot of photon energy (keV) versus intensity.

# Can we benefit from Qt?



PAUL SCHERRER INSTITUT



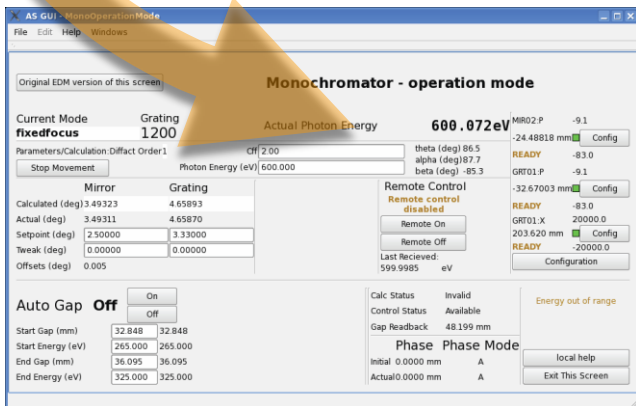
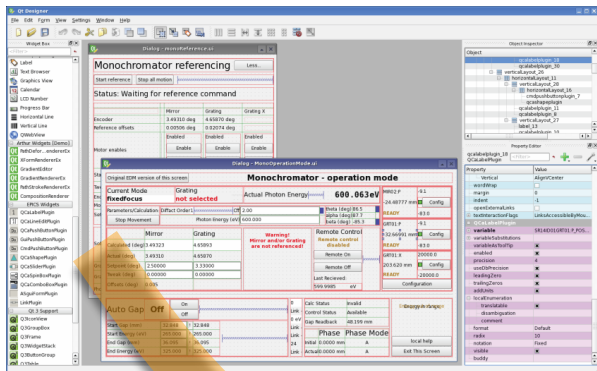
- The Paul Scherrer Institute:  
**MEDM conversion tools**
- The Australian Synchrotron:  
**Unifying GUI system**
- Lyncean Technologies:  
**Python physics and science applications.**



# Collaboration results – EPICSQT + caQtDM



- Just like before – only combined!
- Common documentation
- Common packaging
- Includes all functionality from the Australian Synchrotron application
- Includes PSI's MEDM conversion tools and extended functionality



# EPICSQt



Qt Designer

File Edit Form View Settings Window Help

Widget Box

Filter

- QProgressBar
- Horizontal Line
- Vertical Line
- Qt DeclarativeView
- QWebView
- Arthur Widgets [Demo]
- Display Widgets [Examples]
- Phonon
- EPICS Widgets
- QEAnalogProgressBar
- QEBitStatus
- QECheckBox
- QEComboBox
- QEConfiguredLayout
- QFileBrowser
- QEFileImage
- QEForm
- QEImage
- QELabel
- QELineEdit
- QELog
- QELogin
- QENumericEdit
- QEPeriodic
- QEPlot
- QEPushButton
- QEPVProperties
- QERadioButton
- QERadioButtonGroup
- QERecipe
- QEScript
- QEShape

\$(MOTOR) - geobrickMinimal.ui\*

1.2041 1.2052 mrad

0.3000 < > Stop Kill

\$(MOTOR) - geobrickMore.ui\*

Operation

1.2041 1.2052 mrad

0.3000 < > Sync Stop Kill

Raw motor position 12052

Raw encoder position 12052

Following error 0.0000

Max following error 0.0000

Geobrick control

Low limit

Limit violation

High limit

Encoder loss

Amp fault

Reset

User configuration

Velocity 1.0000 1.0000 mrad/se

Homed

User direction  Positive  Negative

User high limit 100.0000 mrad

User low limit -100.0000 mrad

User offset 0.0000 mrad

Home << >>

Set / use  Use  Set

Open Plot... More...

Property Editor

Filter

qeform : QEForm

Property	Value
Bold	<input type="checkbox"/>
Italic	<input type="checkbox"/>
Underline	<input type="checkbox"/>
Strikeout	<input type="checkbox"/>
Kerning	<input checked="" type="checkbox"/>
Antialiasing	PreferDefault
cursor	Arrow
mouseTracking	<input type="checkbox"/>
focusPolicy	NoFocus
contextMenuPolicy	DefaultContextMenu
acceptDrops	<input checked="" type="checkbox"/>
tooltip	
statusTip	
whatsThis	
accessibleName	
accessibleDescription	
layoutDirection	LeftToRight
autoFillBackground	<input type="checkbox"/>
stylesheet	
locale	English, UnitedStates
Language	English
Country	UnitedStates
inputMethodHints	ImhNone
<b>QEForm</b>	
uiFile	geobrickCore.ui
variableSubstitutions	MOTOR=SR12ID01MIR02:...
handleGuiLaunchRequests	<input type="checkbox"/>
resizeContents	<input checked="" type="checkbox"/>
messageSourceId	0
messageFormFilter	Match
messageSourceFilter	None

Property Editor Object Inspector

# EPICSQt



### ID12B Focus - Raw Image (on SR12ID01OPI02)

Image Cursor Mode Markups Zoom Flip/Rotate EngineeringTools Analysis

Centroid

(1142,265)=38 13:39:28.700 Zoom: 39%

### SR08ID01SST23:Z

File Edit Tools Options Help Windows

#### 2B Large CT Z

-52.5000 -52.5000 mm  Ready  
2.5000 < >  Stop  Low limit  
 Limit violation  
Raw motor position -262500  High limit  
Raw encoder position -262500  Encoder loss   
Following error 26.2500  Amp fault  
Max following error 89.7497   Unexpected limit fault   
Geobrick control Open loop  Homed

#### User Settings

Velocity  
Offset  
Direction  
Low limit  
Backlash dist  
Copy RBV to VAL

#### Home Procedure

Home flag: Negative  
1. Adjust soft limits  
2. Move to Negative  
3. Press active button  
4. Reset soft limits

### Rotation stage

File Edit Tools Options >>

-52.5000 -52.5000 mm  
2.5000 < >  Stop

### ID12B Focus - Raw Image - Statistics (on SR12ID01OPI02)

Statistics View

**Statistics:**  
Compute Statistics Yes Yes  
Background Width 1 1  
Minimum 0 Maximum 226  
Minimum X 0 Maximum X 1585  
Minimum Y 6 Maximum Y 43  
Total 47205912 Net -3583763  
Mean 24 Sigma 19.6

**Time Series:**  
     
Number of Points 1000  
Current Point 145  
Read Rate 1 second

Min Y

Y pixel location of minimum value in the array

Total Net Min Max Min X Min Y Max X Max Y Mean Sigma

Information: Opening areaDetector/ADApp/op/ui/plotTimeSeries.ui

# EPICSQt - differentiation

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- UI presentation application that is not restricted to medm behaviour
  - Docks
  - Tabs
  - Application specific menu bars and toolbars
- Widget set that is not restricted to medm behaviour

# EPICSQt update

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# EPICSQt update - GUIs for Beamline Users





# EPICSQt update



**Change User Level**

Current Level: User

Login as:

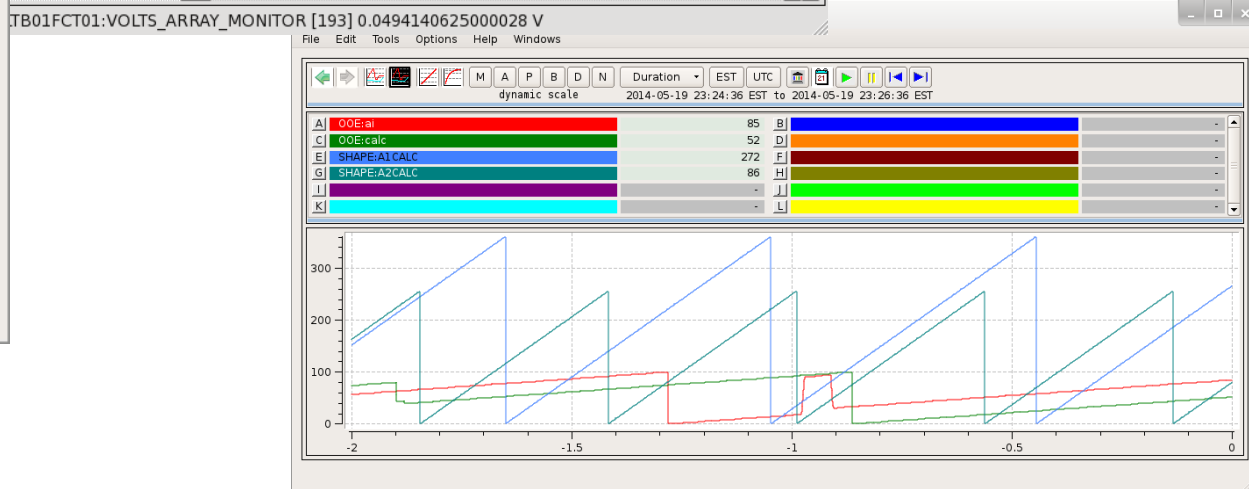
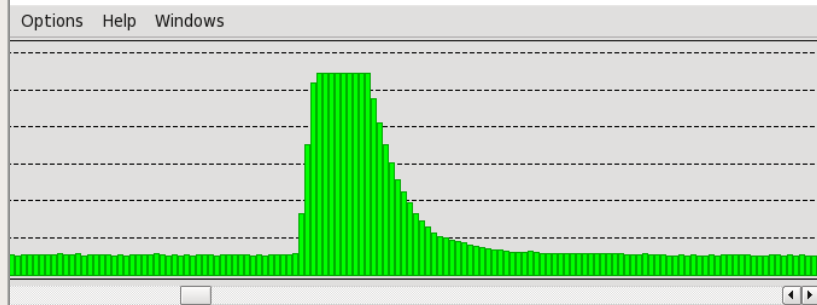
User

Scientist

Engineer

Login Logout

Cancel



- User levels
- Plotting
- Stripcharts

# EPICSQt update



- PV Scratch pad tool
- Logging

Simple logging example

User

Time	Type	Message
2013/01/04 - 17:33:52	INFO	The user type was changed from 'User' to 'Scientist'
2013/01/04 - 17:33:54	INFO	The user type was changed from 'Scientist' to 'Engineer'
2013/01/04 - 17:33:56	INFO	The user type was changed from 'Engineer' to 'User'

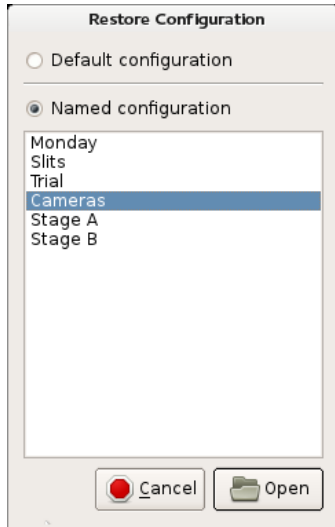
Info messages     Warning messages     Error messages

Information: The user type was changed from 'Engineer' to 'User'

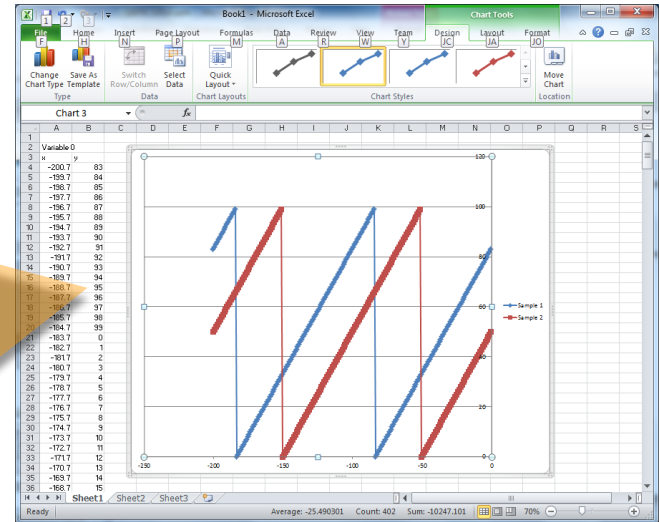
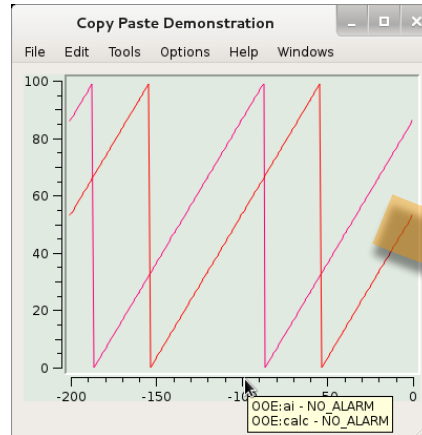
File Edit Tools Options Help Windows

PV Name	Description	Value
SR11BCM01:CURRENT_MONITOR	BCM Smooth Current	6.679 mA
SR11BCM01:LIFETIME_MONITOR	BCM Lifetime	18.29 Hrs
SR11BCM01:LIFETIME_MONITOR.EGU	BCM Lifetime	Hrs

# EPICSQt update



- Configuration Save/Restore
- Improved cut and paste



# EPICSQt update



- Dynamic tables
- PV Recipes
- User script management

The image shows three Qt windows illustrating dynamic tables. The top window, 'Form - ccg\_unit.ui', contains a table with three rows and three columns. The middle window, 'Form - ccg\_sector.ui', contains a table with three rows and three columns. The bottom window, 'Form - ccg\_all.ui+', contains a large table with 12 columns and 12 rows, organized into a 4x3 grid of 3x4 sub-tables. Each sub-table has three columns: a status column (e.g., 'Ok'), a PV name column, and a value column (e.g., '2.7e-10 mbar').

The image shows two Qt windows for recipe and script management. The top window, 'Recipe component', has a menu bar (File, Edit, Tools, Options, Help, Windows) and a toolbar with buttons for 'New', 'Save', 'Delete', 'Apply', and 'Read'. Below the toolbar is a dropdown menu showing 'Experiment start'. The bottom window, 'Script example', has a menu bar (File, Edit, Tools, Options, Help, Windows) and a toolbar with buttons for 'New', 'Save', 'Delete', 'Execute', and 'Abort'. Below the toolbar are buttons for 'Add', 'Remove', 'Up', 'Down', 'Copy', and 'Paste'. The main area contains a table with columns: #, Enable, Program, Parameter, Directory, Timeout, Stop, and Log. The table has three rows of data.

#	Enable	Program	Parameter	Directory	Timeout	Stop	Log
1	<input checked="" type="checkbox"/>	init	5		10 s	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	<input checked="" type="checkbox"/>	scan			0 s	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3	<input checked="" type="checkbox"/>	copy			0 s	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Information: Opening /home/andrew/script.ui

# EPICSQt update



- Documentation
- PV properties tool



PV Properties <3>

File Edit Help Windows

NAME SR11BCM01:CURRENT\_MONITOR

VAL 200.4032 mA

HOST IRIDIUM:5064

TIME 2013-07-15 22:02:40.000541038 EST

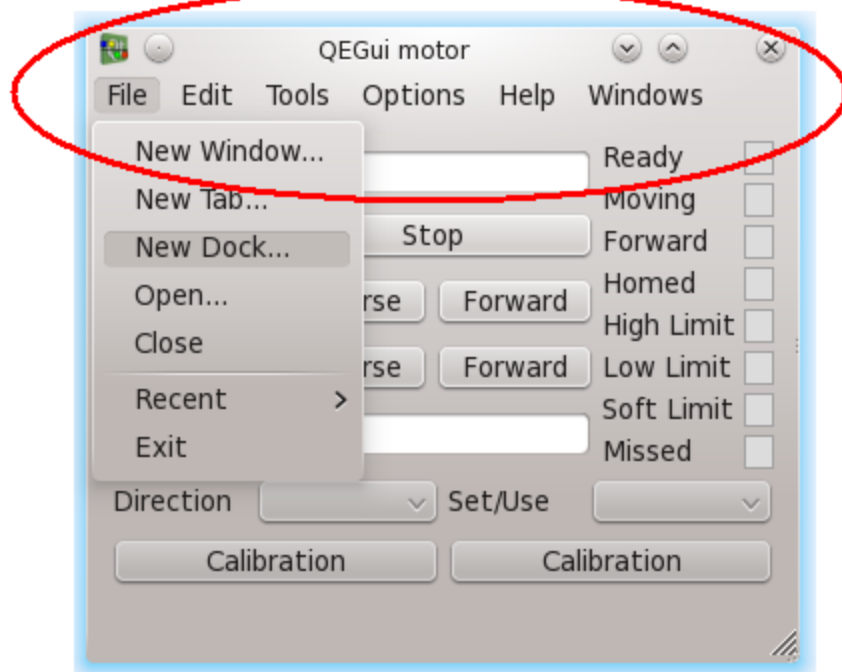
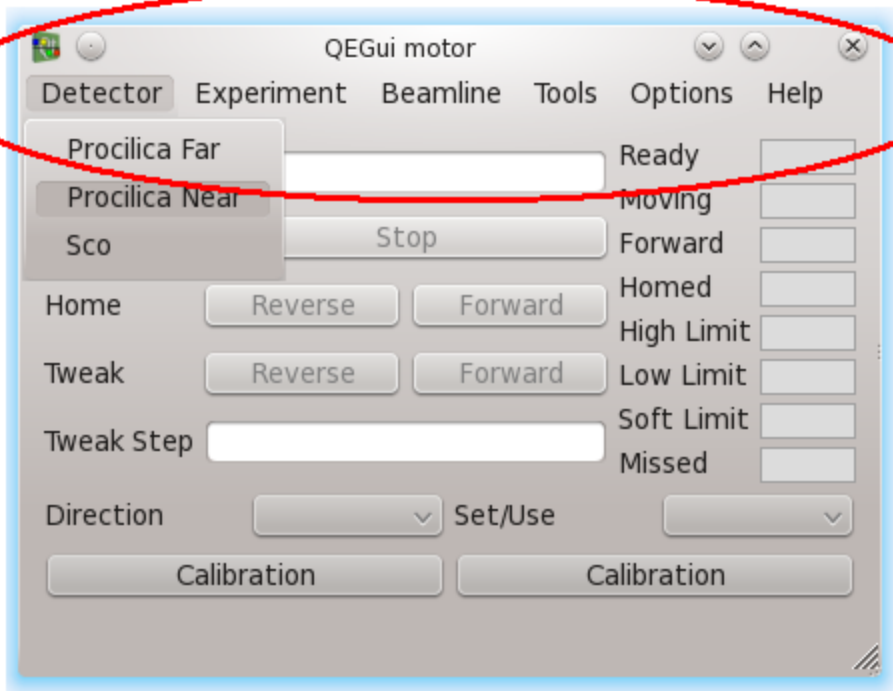
DBF DBF\_DOUBLE INDEX 1 / 1

Field	Value
RTYP	calc
NAME	SR11BCM01:CURRENT_MONITOR
DESC	Smooth Current
ASG	
SCAN	1 second
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

# EPICSQt update



- Menu and tool bar customisation





# EPICSQt update



- Imaging
  - Interactive AreaDetector integration
  - Interactive user tasks
  - Analysis tools
  - Local presentation options

The screenshot displays the EPICSQt software interface. The main window, titled "MPG stream", shows a grayscale image of a beam profile. The image is overlaid with several analysis tools and parameters:

- Regions:** Four regions are defined with their respective X, Y, Width, and Height values:

Region	X	Y	Width	Height
Region 1	702	642	337	332
Region 2	829	467	185	120
Region 3	881	307	188	115
Region 4	916	129	195	113
- Arbitrary line profile:** X1: 742, Y1: 876, X2: 981, Y2: 916, Width: 1.
- Ellipse:** X1: 845, Y1: 520, X2: 1000, Y2: 550, Width: 1.
- Targeting:** Beam X: 841, Beam Y: 804, Target X: 899, Target Y: 739.
- Vertical line profile:** X: 417, Width: 1.
- Horizontal line profile:** Y: 1106, Width: 1.

At the bottom left, there are two small windows: "Horizontal Slice Profile" and "Arbitrary Profile", both showing line graphs of the beam profile. At the bottom right, there is a "Brightness / Contrast" dialog box with the following options:

- Auto Brightness and Contrast
- Contrast Reversal
- Auto all
- Reset
- Brightness: 0%
- Contrast: 100%

Information: Disconnected variable: THIS\_IS\_NO\_A\_PV2 (Source QImage)

# Get involved



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