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caQtDM: PSI's display manager

caQtDM presentation, APS, Argonne, USA, June 2018

Outline of the presentation

- caQtDM: PSI's new display manager, Version 4.2.1 (already presented in Lundt, Sweden)
  - Multiplatform capability
  - A new world for .ui file loading using the web
  - Multiple control system support through plugins
  - Easy integration of new widgets using the cs interface
  - Some recent new features
- Signals and Slots for various interactions
- Howto's (things that are not just obvious or that you are aware of)
- Conclusion

caQtDM: PSI's new display manager, V4.2.1

- caQtDM is an EPICS display manager written in C++ and uses Qt as graphical user interface:

- caQtDM is PSI's actual successor of MEDM and follows its philosophy regarding widget functionality. (MEDM manual is still a good reference to begin with)
- caQtDM has been developed as a modern display tool (C++, Qt, plugins)
- caQtDM has now many new features, that makes it very versatile (multiplatform, multi-CS, easy integration of new widgets, web support, parallelization of camera data conversion)
- caQtDM is very reactive to its users (bug fixes and features)

caQtDM: PSI's new display manager, V4.1.0

Multiplatform capability:

caQtDM runs on Linux's, MS windows, Mac OS X, iOS and Android. In principle on any platform where you find Qt and EPICS.

- caQtDM has been tested with Qt4.8 to Qt5.8 with preferentially Qwt6.1.1 (multithreading support) and EPICS 3.14.12 (some users already build caQtDM with EPICS 3.15, 3.16 and 7.0)
- caQtDM will use the local file system when not specified otherwise (for using a web server use option –http)
- caQtDM will need on IOS or Android a WEB server in order to get its description files (.ui). caQtDM will then come then with its start settings display.

caQtDM: PSI's new display manager, V4.1.0

caQtDM: a new world for ui file loading using the web

- Standard usage is loading a local file: caQtDM [options] filename
- More and more files are located at a web server and versioning becomes important, caQtDM has to account for this new way of life:
  - Actually that is just the way caQtDM is implemented on our handheld devices like tablets and phones.
  - Therefore a natural extension using –httpconfig command line option

file based:
- nfs/smb
- local environment
- command line needed

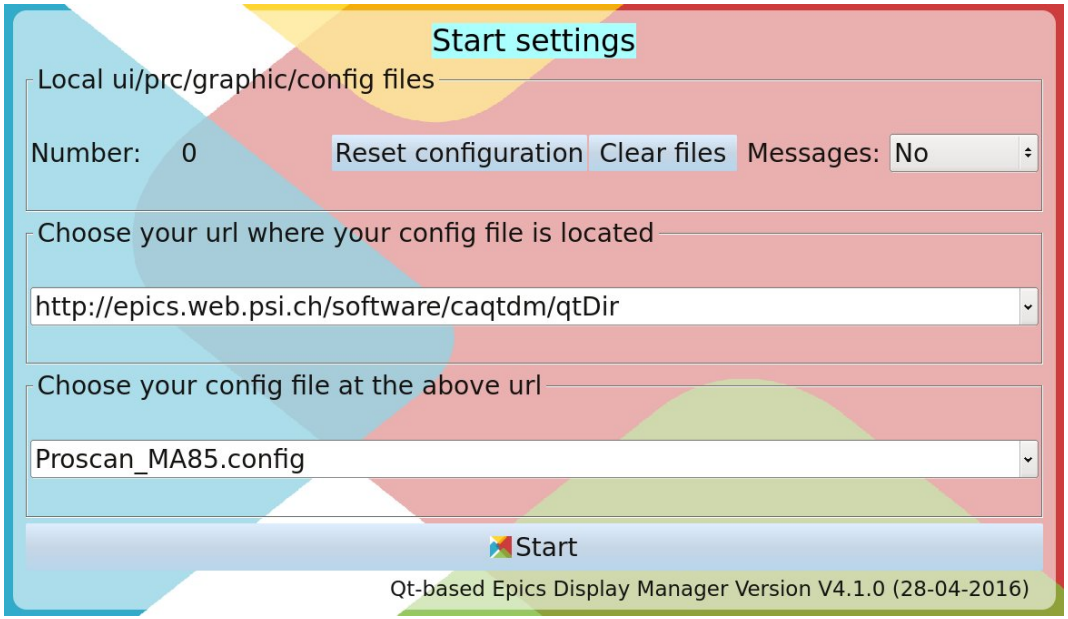
http based:
- local view
- versioning
- encapsulated config/environment

caQtDM: a new world for ui file loading using the web (implementation)

caQtDM has multiple ways to get files from a web server:

By using the option –url or the option –httpconfig.

Last option is default for handheld devices; caQtDM will popup with:



caQtDM: a new world for ui file loading using the web (implementation)

What is then needed on the file server:

- A config file specified in the start settings (example: Proscan_MA85.config)

- Following contents of config file:

  EPICS_CA_MAX_ARRAY_BYTES 150000000
  EPICS_CA_AUTO_ADDR_LIST NO
  EPICS_CA_ADDR_LIST hipa-cagw02.psi.ch
  EPICS_CA_SERVER_PORT 5062
  CAQTDM_LAUNCHFILE launcherhipa.ui
  CAQTDM_URL_DISPLAY_PATH http://epics.web.psi.ch/software/caqtdm/qtDir/Hipa

- Ui launchfile and other files in CAQTDM_URL_DISPLAY_PATH

caQtDM: PSI's new display manager, V4.2.1

Multiple control system support since version 3.9.4:

An effort was made to fully separate the display part from the data acquisition part by introducing a plugin scheme for the control system support:

- Easy integration of other systems (databases, control systems, any data source)
- Writing a plugin will not need new code in caQtDM and does not need a rebuild.

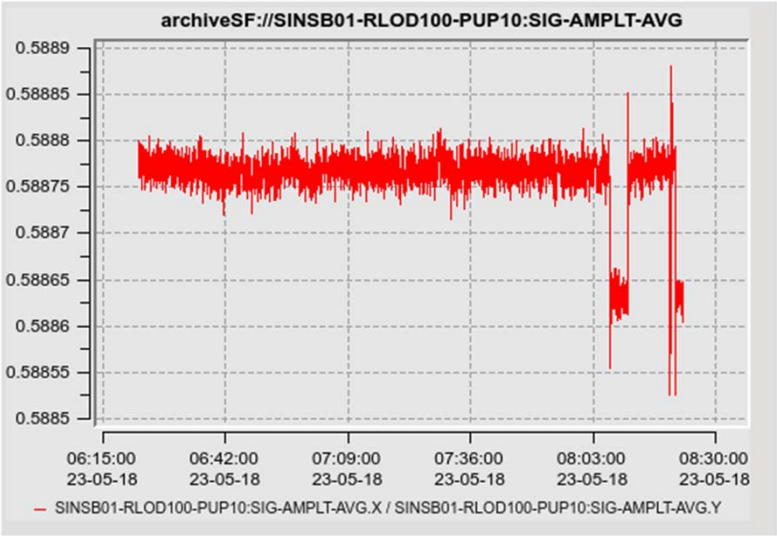
Actual plugins: EPICS, BSREAD (a beam synchronous data acquisition using ∅ MQ), EPICS4, channel access archive plugin and other more recent archive using https, a demo plugin as simple example.

Example : use of archive data in caCartesian widget through the archive plugin

- Add in designer a channel as follows:
  - For http and https:
    archiveSF://channel.X;archiveSF://channel.Y
  - For channel access:
    archiveCA://channel.X; archiveCA://channel.Y
- Add in designer the following dynamic string properties:
  (when missing, plugin will use defaults)
  - secondsPast with value 3600 seconds
  - secondsUpdate with value 10 seconds
  - archiverIndex with value:
    https::/data-api.psi.ch/sf/query for archiveSF
    /gfa/archiver-data/archive_PRO_ST/index for archiveCA
- To use at other labs using a webserver, one could modify the method «finishreply» in sfRetrieval.cpp

caQtDM: PSI's new display manager, V4.2.1

Example : use of archive data in caCartesian widget through the archive plugin



caCartesianPlot	
Title	archiveSF://SINSB01-RLOD100-PUP10:SIG-AMPLT-AVG
TitleX	
TitleY	
channelList_1	archiveSF://SINSB01-RLOD100-PUP10:SIG-AMPLT-AVG.X; archiveSF://SINSB01-RLOD100-PUP10:SIG-AMPLT-AVG.Y
channels_1	archiveSF://SINSB01-RLOD100-PUP10:SIG-AMPLT-AVG.X;archiveSF://SINSB01-RLOD100-PUP10:SIG-AMPLT-AVG.Y
Style_1	ThinLines
symbol_1	NoSymbol
color_1	[255, 0, 0] (255)

Dynamic Properties	
secondsPast	7200
secondsUpdate	5
archiverIndex	https://data-api.psi.ch/sf/query
nrOfBins	5000

Easy Integration of new widgets (get a look at caLineDraw.cpp)

- gives the possibility of an easy integration of widgets, the control system can be addressed from within a widget.
- The advantage is to give an user the possibility to integrate its own widget, avoiding that he has to dig into the main code.
  - Just populate the routines:
    - caActivate to start data acquisition
    - caDataUpdate to update the widget
    - getWidgetInfo and createContextMenu for context info
  - No write routine is implemented, but one could use signal and slots
- A simple demo widget has been integrated that can be used as template for new widgets: caLineDraw. This widget is almost equivalent to caLineEdit, but uses less CPU.

caQtDM: PSI's new display manager, V4.2.1

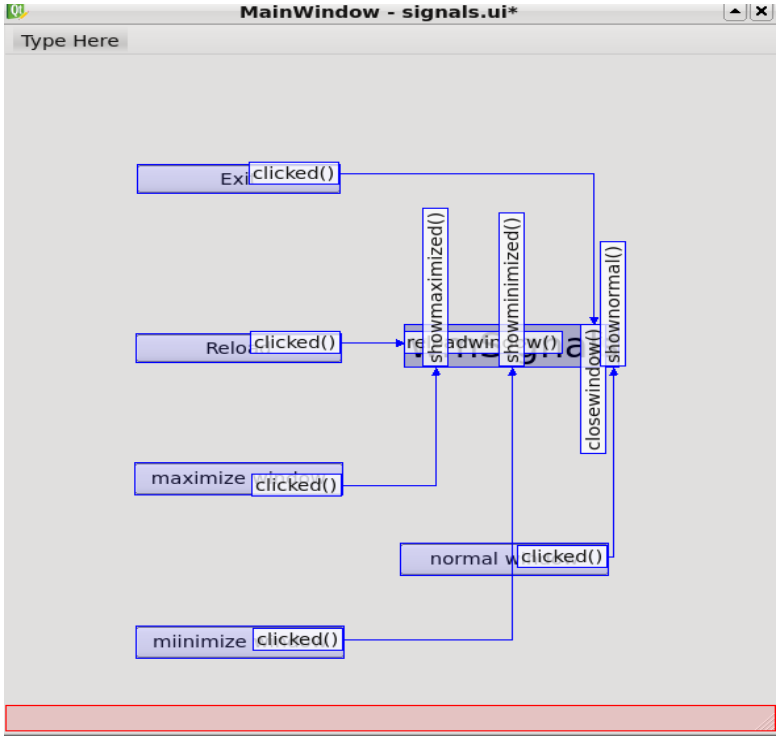
Some recent new features: (detailed in howto's part)

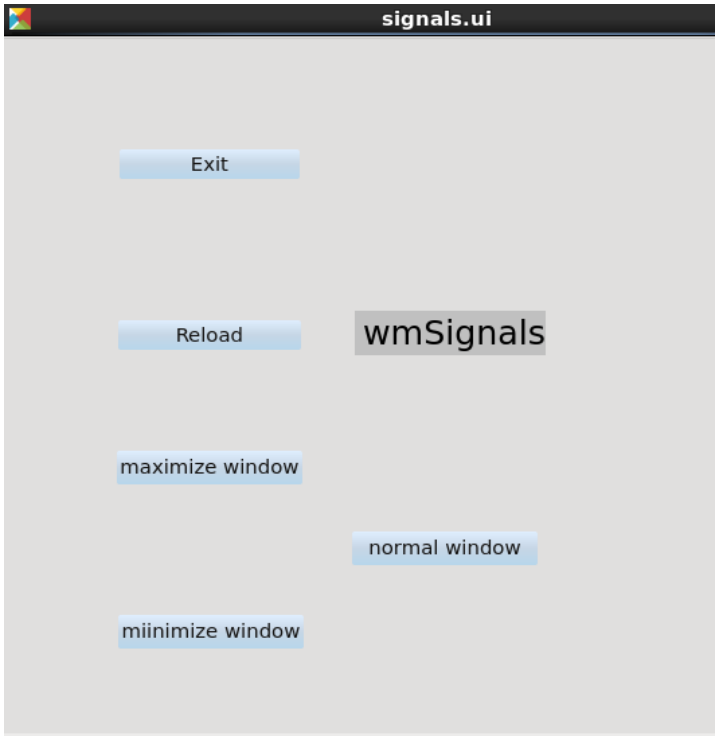
- Piping gives the possibility to dynamically build ui files for display and pipe to caQtDM.
- caCamera uses now multicore parallelism of calculations for converting a waveform to an image and implements various camera formats: mono, rgb, Bayer, YUV with all possible waveform datatypes)
- Internal macro strings are defined; for example $(CAQTDM_INTERNAL_UIPATH) can be used for specifying shell script execution relativ to a found ui file.
- Added possibility to close channels instead of suspending channels in invisible tabs (set environment variable CAQTDM_OPTIMIZE_EPICS3CONNECTIONS)
- Regex modification of macros
- More extensiv use of signals and slots:

  maximize/minimize/close/reload window
  transfer of values to other widgets
  driving animations, hide and show widgets, positioning of widgets
  set tabindex of tab widget

caQtDM: PSI's new display manager, V4.2.1

Howto's : Signals and slots; window interaction) : designer edit signals/slots





As well as ctrl+ and ctrl- for increasing and decreasing window size, ctrl+R for reload

caQtDM: PSI's new display manager, V4.2.1

Howto's : Signals and slots; set index of QTabWidget/QStackedWidget

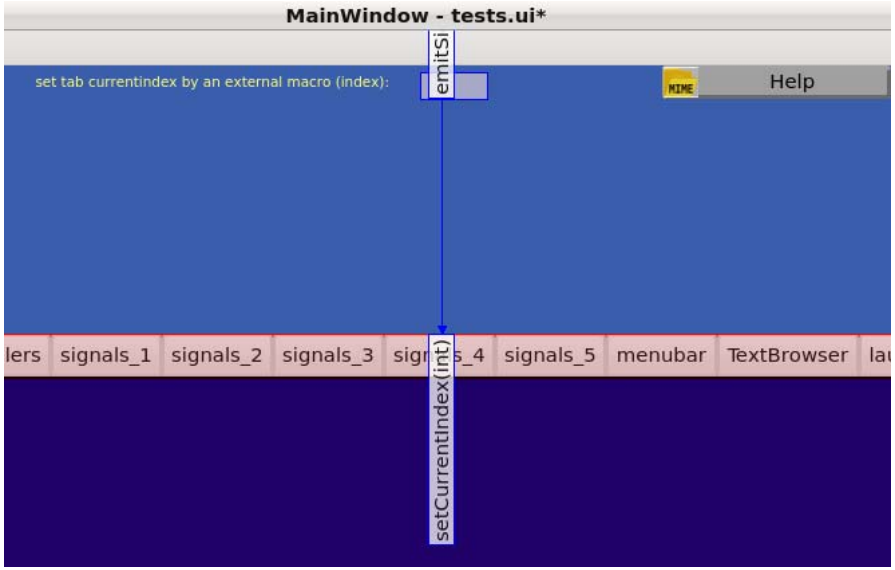
Example at startup

Use caCalc with calculation on first change

cacalc_51 : caCalc

Property	Value
caCalc	
variable	tab
variableType	scalar
foreground	[0, 0, 0] (255)
background	[192, 192, 192] (255)
channelList	
channels	
calc	A=0?$(index):0
channel	tab
channelB	
channelC	
channelD	
initialValue	0.000000
precision	0
eventSignal	onFirstChange

Define signal and slot from calc to tabwidget



Example : start caQtDM with –macro index=2

caQtDM: PSI's new display manager, V4.2.1

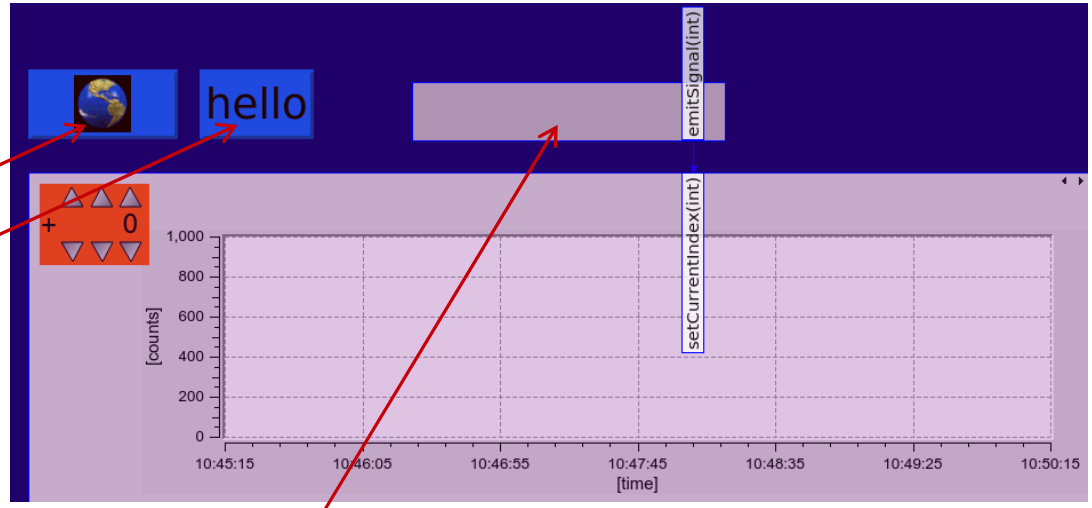
Howto's : Signals and slots; set index of QTabWidget/QStackedWidget

Example on variable or channel change

cacalc_19 : caCalc

Property	Value
caCalc	
variable	one
variableType	scalar
foreground	[0, 0, 0] (255)
background	[192, 192, 192] (255)
channelList	
channels	
calc	
channel	
channelB	
channelC	
channelD	
initialValue	0.000000
precision	0
eventSignal	onAnyChange

Define signal and slot from calc to tabwidget

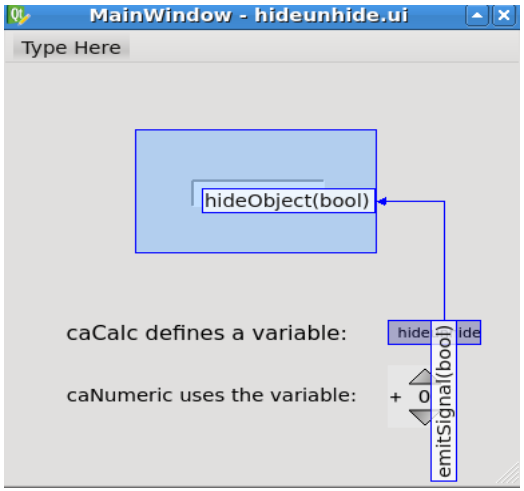


caMessageButton writing value to variable/channel

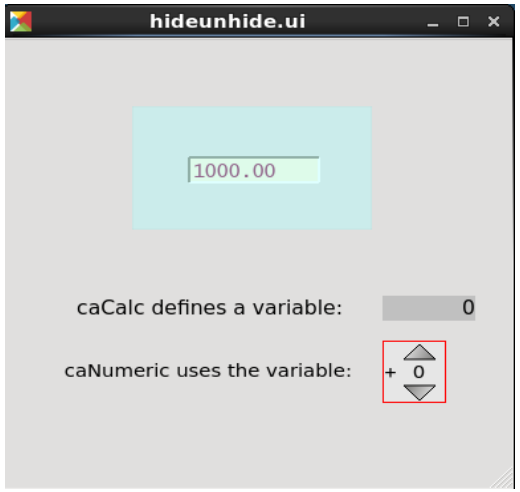
caCalc emitting signal onAnyChange of value

caQtDM: PSI's new display manager, V4.2.1

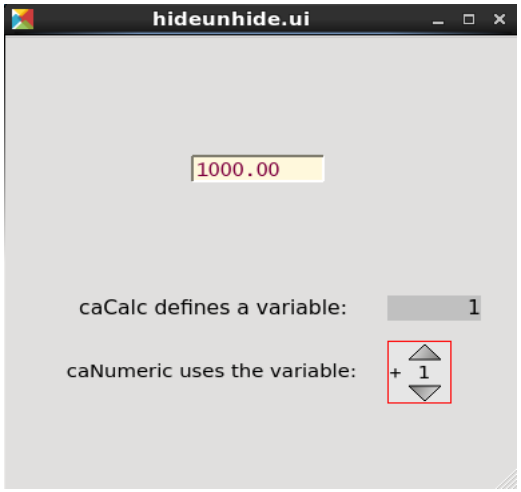
Howto's : Signals and slots ; hide objects



unhidden

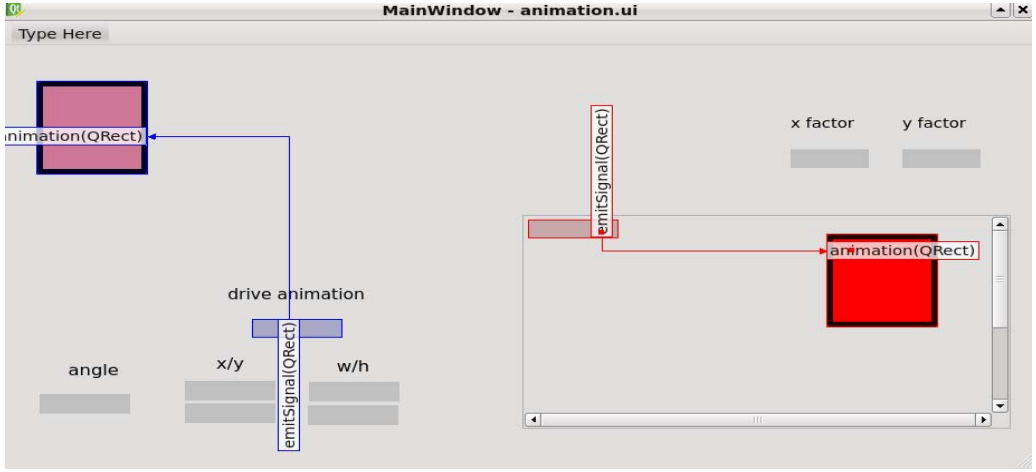


hidden

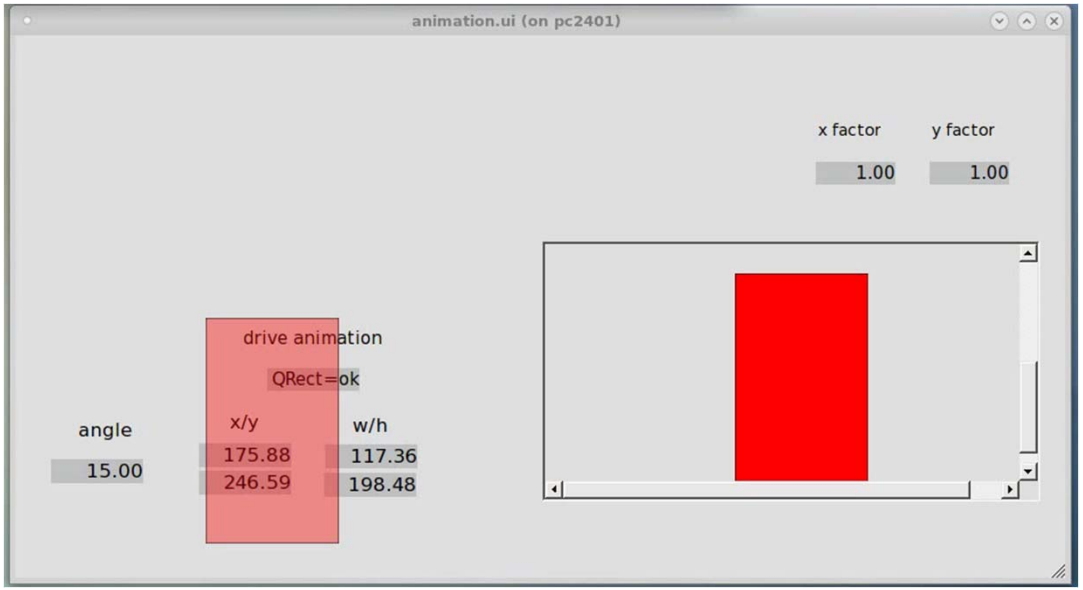


caQtDM: PSI's new display manager, V4.2.1

Howto's: signal and slots; animate objects: (use special calc property %QRECT)

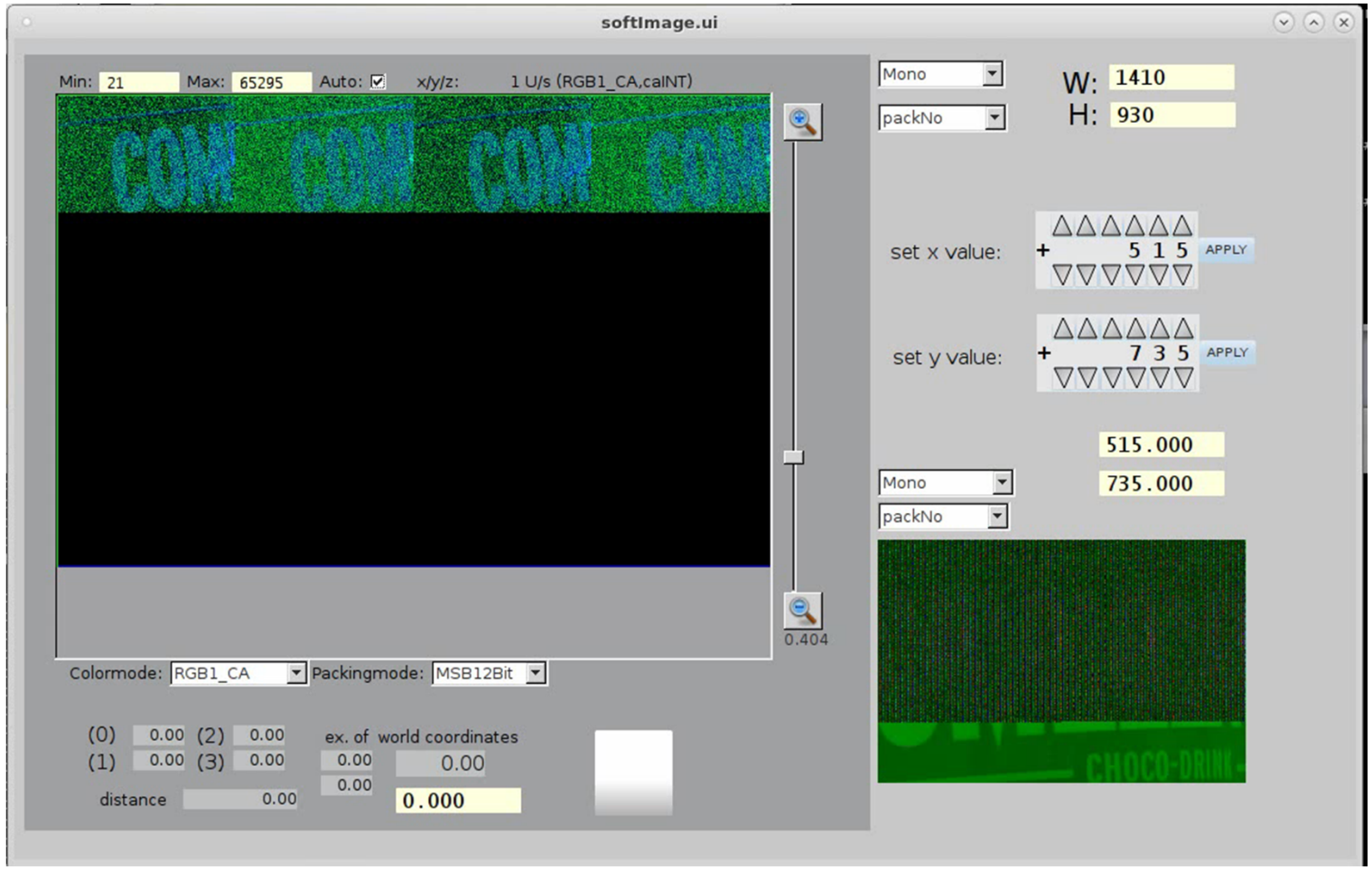


variable	QRectDrive
variableType	scalar
foreground	[0, 0, 0] (255)
background	[192, 192, 192] (255)
channelList	
channels	
calc	%QRect
channel	calcVariationX
channelB	calcVariationY
channelC	calcVariationWidth
channelD	calcVariationHeight
initialValue	0.000000
precision	2
eventSignal	onAnyChange



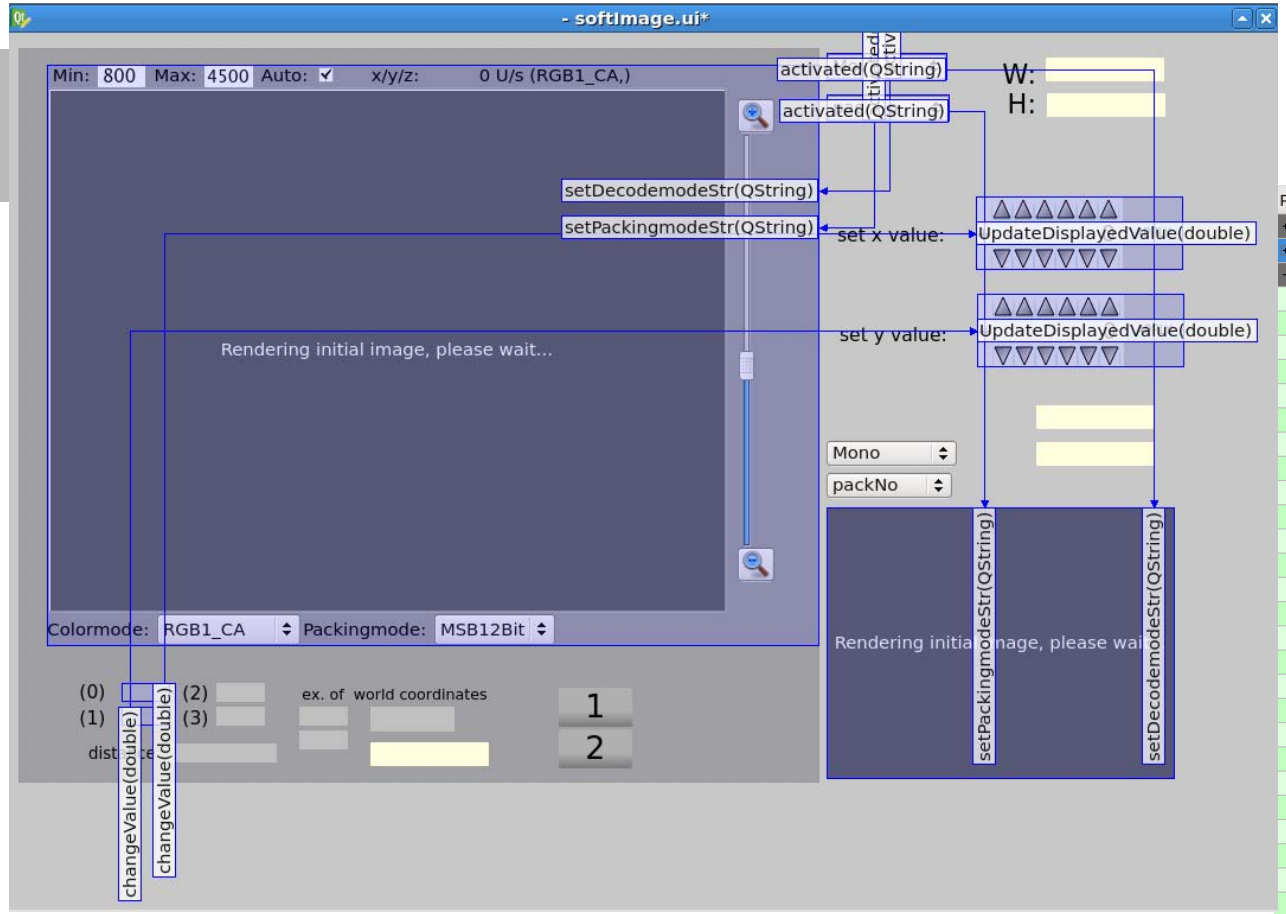
caQtDM: PSI's new display manager, V4.2.1

Howto's: signal and slots; camera widget, setting channels by cursor



caQtDM: PSI's new display manager, V4.2.1

Howto's: signal and slots; camera widget, setting channels by cursor



Property	Value
QObject	
QWidget	
caCamera	
channelData	ACM:PICTURE
channelWidth	ACM:PICTURE:WIDTH
channelHeight	ACM:PICTURE:HEIGHT
simpleZoomedView	☐
Zoom	Yes
automaticLevels	☑
minLevel	800
maxLevel	4500
colorMode	RGB1_CA
colorModeOverwriteChannel	
packMode	MSB12Bit
packingModeOverwriteChannel	
showComboBoxes	☑
ColorMap	as_is
customColorMap	
discreteCustomColorMap	☐
ROI_readChannelsList	FIGX; FIGY; FIGW; FIGH
ROI_readChannels	FIGX;FIGY;FIGW;FIGH
ROI_readmarkerType	box_crosshairs
ROI_readType	xy_only
ROI_writeChannelsList	FIGX; FIGY; FIGW; FIGH;
ROI_writeChannels	FIGX;FIGY;FIGW;FIGH;
ROI_writemarkerType	box_crosshairs
ROI_writeType	xy_only
channelXaverage	
channelYaverage	

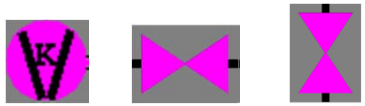
caQtDM: PSI's new display manager, V4.2.1

Howto's: animated gif against visibility:

One may overlap symbols and use visibility calc to show and hide according value; this is the usual medm way, however:

Using an animated gif and using a frame value is more efficient and easier to handle in the designer

Some vacuum symbols:



Some other symbols:

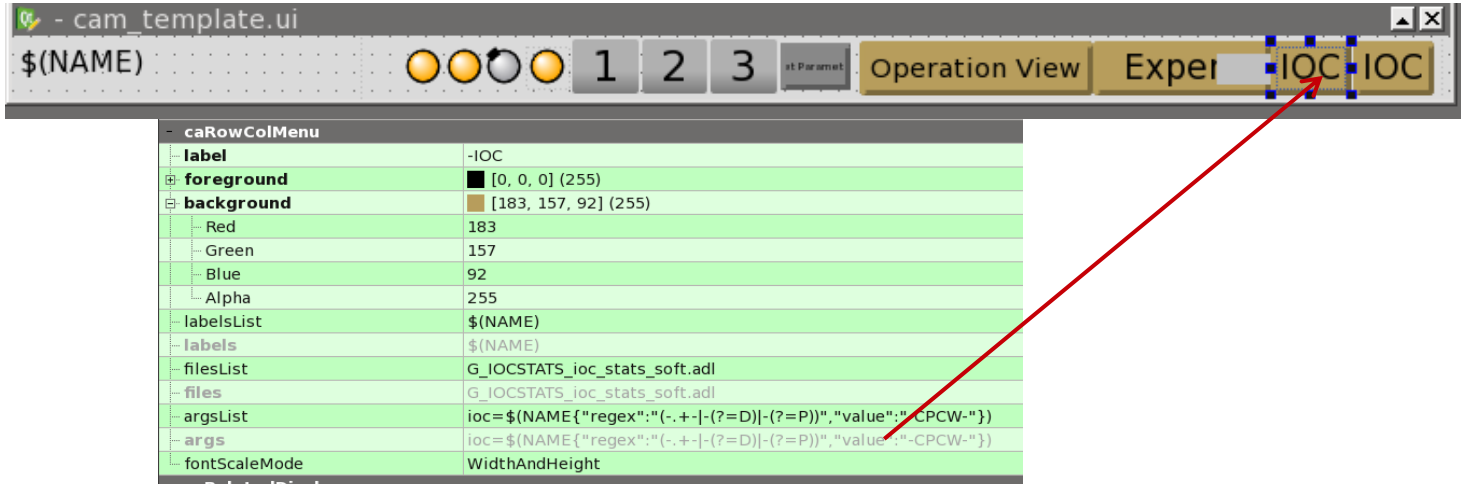
caQtDM: PSI's new display manager, V4.2.1

Howto's: modify macro using regex substitution

Normal macro: IOC=$(NAME)

RegEx macro: IOC=$(NAME{"regex":"(-.+-|-(?=D)|-(?=P))","value":"-CPCW-"})

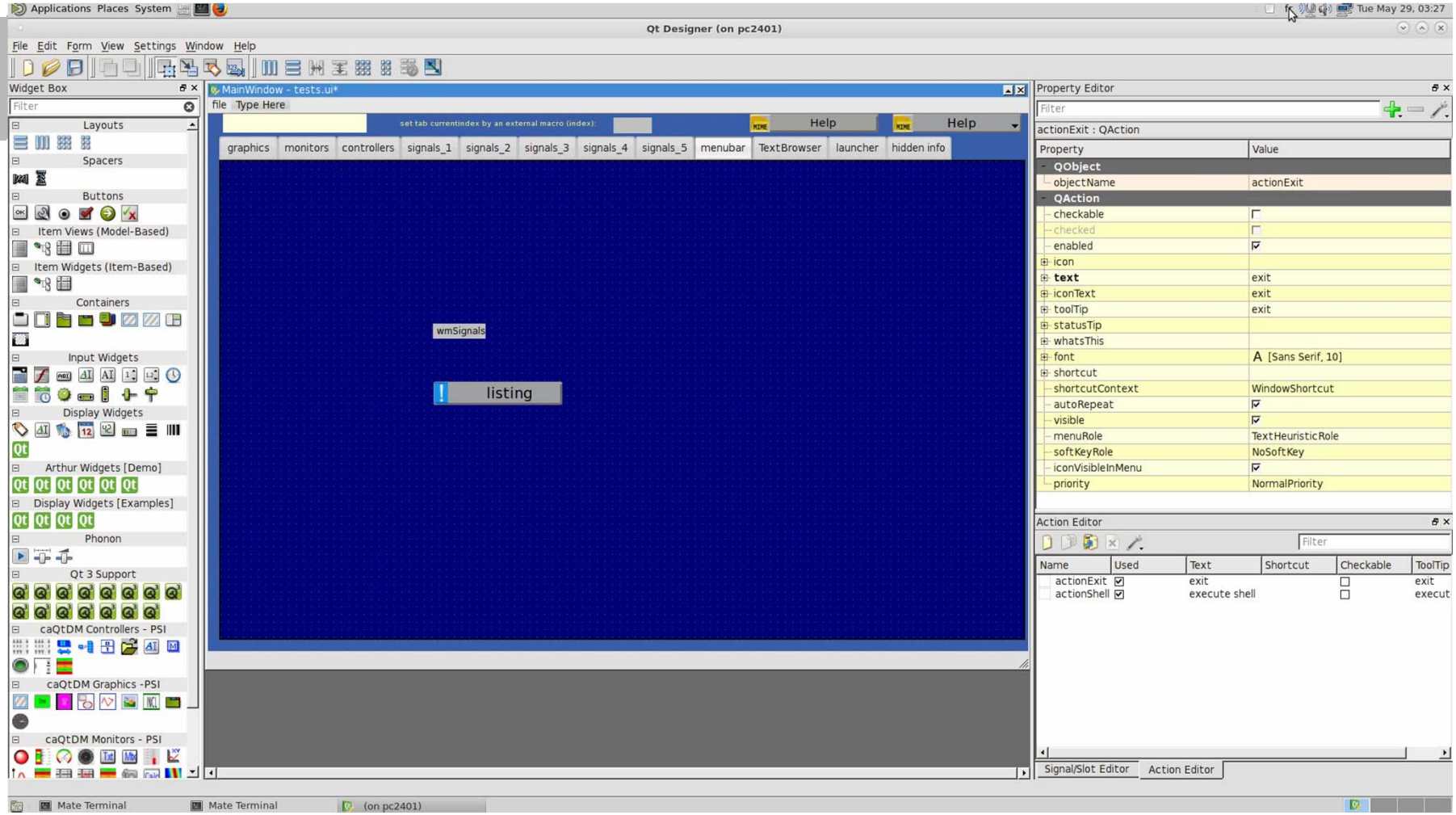
SLG-LCAM-C061	=>	SLG-CPCW-C061
SARBD01-DSCR050	=>	SARBD01-CPCW-DSCR050
SARES10-PSS055	=>	SARES10-CPCW-PSS055



This method simplifies long macro lists by using names that can be generated through some simple rules and conventions.

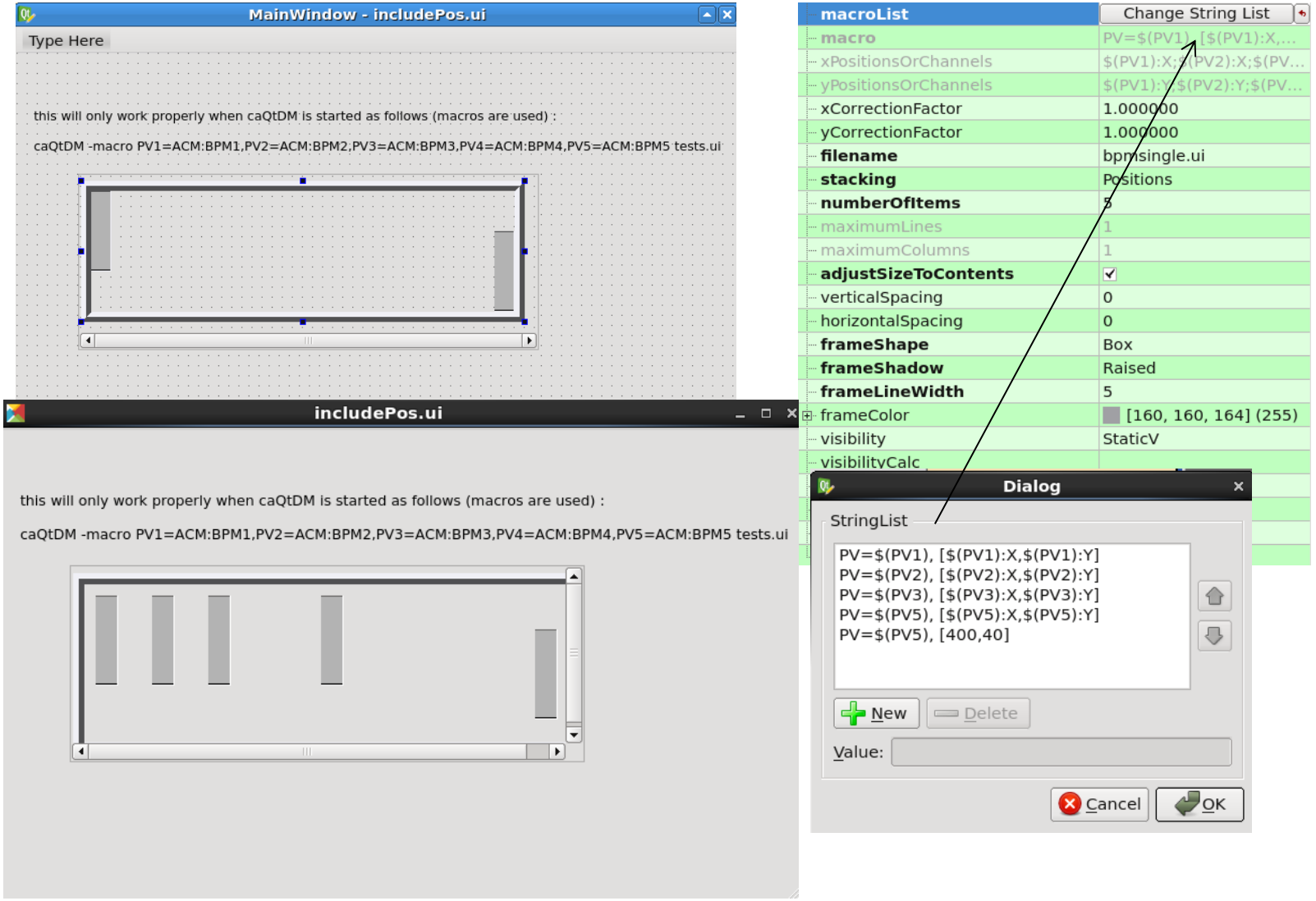
caQtDM: PSI's new display manager, V4.2.1

Howto's: add a menu to a window (use actions and signals)



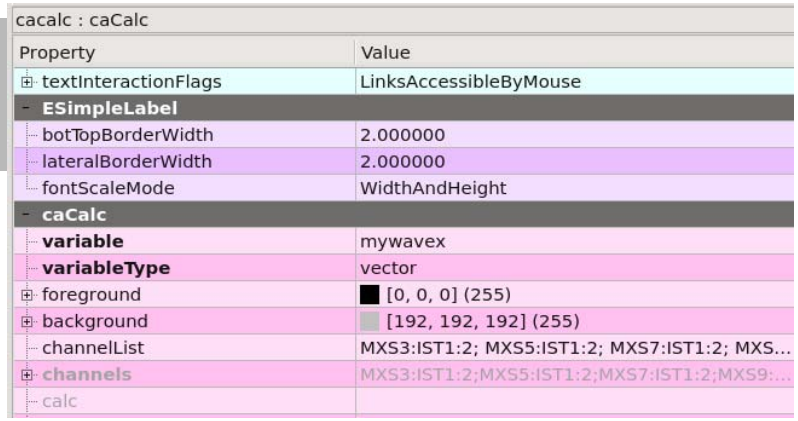
caQtDM: PSI's new display manager, V4.2.1

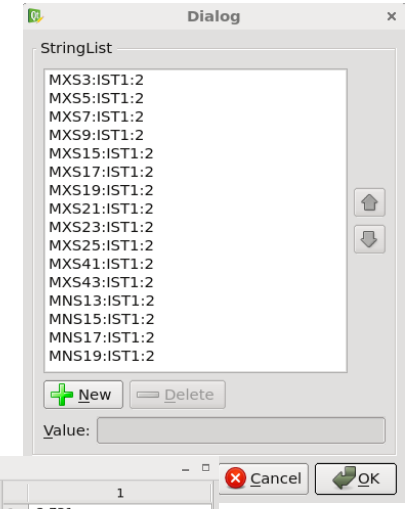
Howto's: display with externally defined positions and channels in cainclude

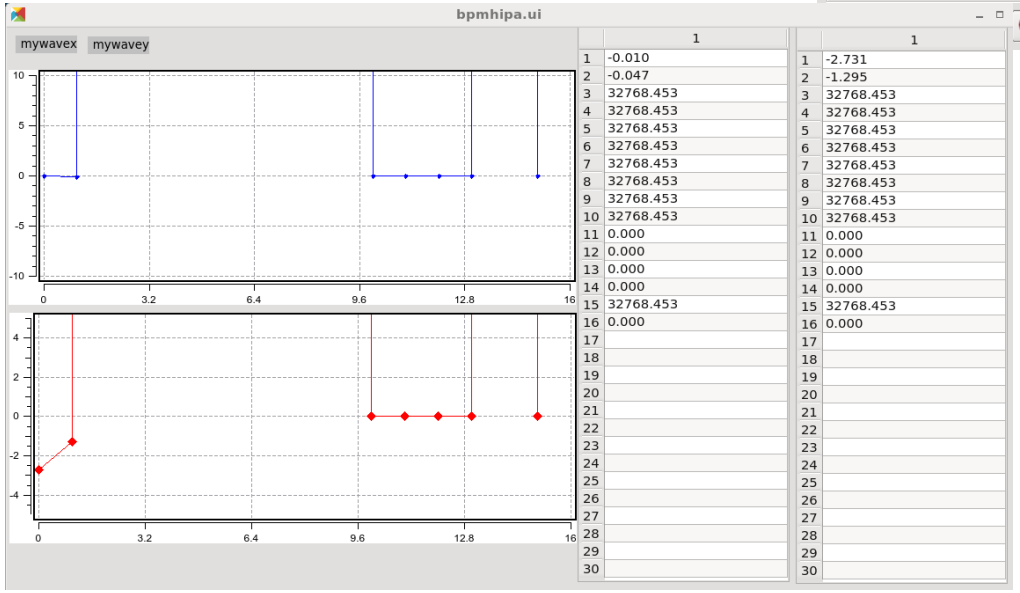


caQtDM: PSI's new display manager, V4.2.1

Howto's: build and display a waveform from a multitude of channels

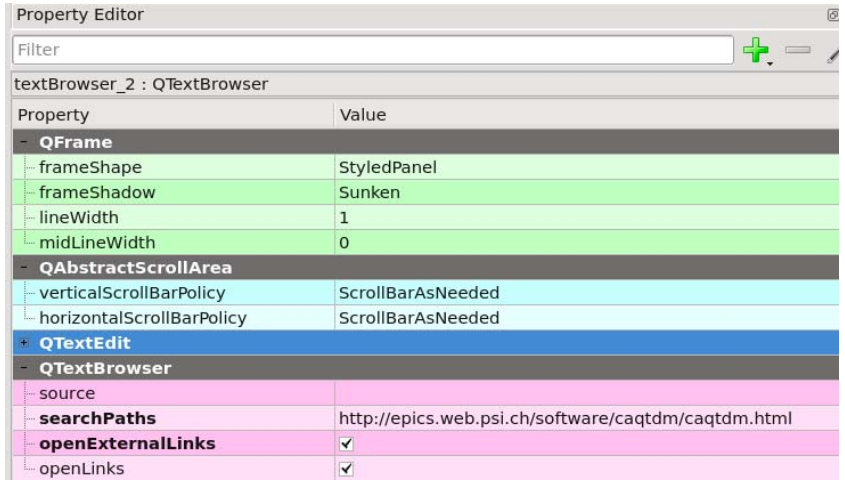






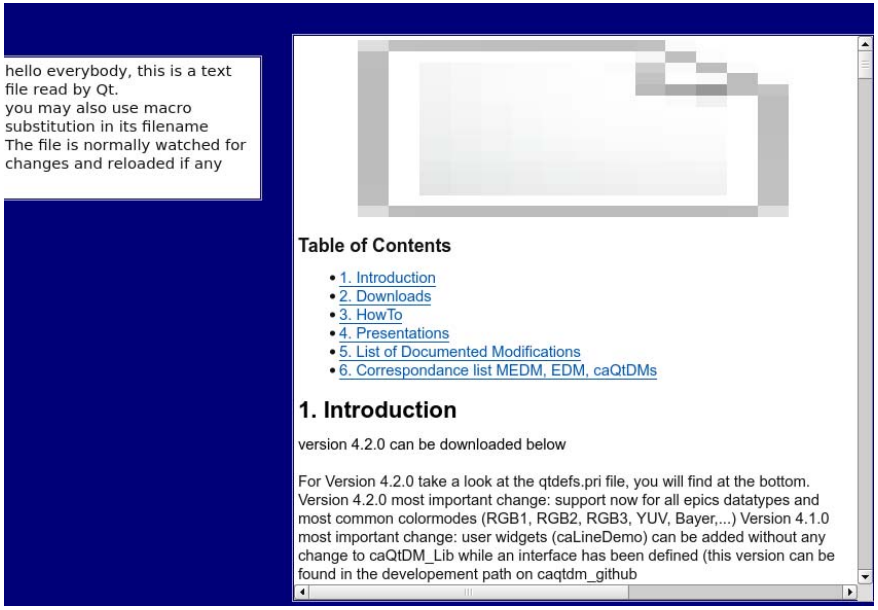
caQtDM: PSI's new display manager, V4.2.1

Howto's: QTextBrowser in caQtDM can also display a html file from a webserver



Filesystem filename; file will be watched for changes (however nfs …)

Url; file will be copied at caQtDM startup to temporary cache



caQtDM: PSI's new display manager, V4.2.1

Howto's: internal macro strings

CAQTDM_INTERNAL_UIPATH =	/afs/psi.ch/user/m/mezger/workarea/ACS/mezger/caQtDM_Project/caQtDM_Tests/
CAQTDM_INTERNAL_STARTTIME =	10:21:06
CAQTDM_INTERNAL_STARTDATE =	29.05.2018
CAQTDM_INTERNAL_VERSION =	V4.2.1_Development_2cf7b284
CAQTDM_INTERNAL_QTVERSION =	4.8.2
CAQTDM_INTERNAL_EXEPATH =	/afs/psi.ch/user/m/mezger/workarea/ACS/mezger/caQtDM_Project/caQtDM_Binaries/
CAQTDM_INTERNAL_PID =	10672
CAQTDM_INTERNAL_HOSTNAME =	pc2401
CAQTDM_INTERNAL_SCREENCOUNT =	2
CAQTDM_INTERNAL_DPI =	107
CAQTDM_INTERNAL_REFRESHRATE =	$(CAQTDM_INTERNAL_REFRESHRATE)
CAQTDM_INTERNAL_DESKTOP_WIDTH =	4480
CAQTDM_INTERNAL_DESKTOP_HEIGHT =	1440
CAQTDM_INTERNAL_CA_ADDRLIST =	hipa-cagw
CAQTDM_INTERNAL_BS_ADDRLIST =	
CAQTDM_INTERNAL_BS_DISPATCHER =	

$(CAQTDM_INTERNAL_UIPATH) can be used for specifying shell script execution relatif to the used ui file.

caQtDM: PSI's new display manager, V4.2.1

Howto's:

Most of the examples shown here
can be found in the file tests.ui !

(in GIT)

Conclusion:

- caQtDM replaced successfully MEDM and follows the demands.
- caQtDM very mature now.
- **caQtDM is well adapted to our needs for all synoptic views**
- caQtDM is used on all possible platforms at PSI

My thanks go to

- The authors of MEDM for their powerful application
- All contributors for their input and code
- All users for their suggestions and bug finding

❑ Thank you for your attention

and have a look at:

http://epics.web.psi.ch/software/caqtdm/

Downloads:


Linux: sources (you may also clone github/caqtdm or download a zip)

MS windows: binary installation package (msi)


Mac OS X: binary distribution package (dmg)


iOS : binary distribution package from apple store (iPad and iPhone)


Android : binary distribution package