Argonne NATIONAL LABORATORY

caQtDM Tutorial

Jim Stevens
APS Controls Group
October 9, 2014

- Based on 2004 “Medm” lecture by Kenneth Evans Jr.
- 2013 Abridged version by Tim Mooney for SSG class

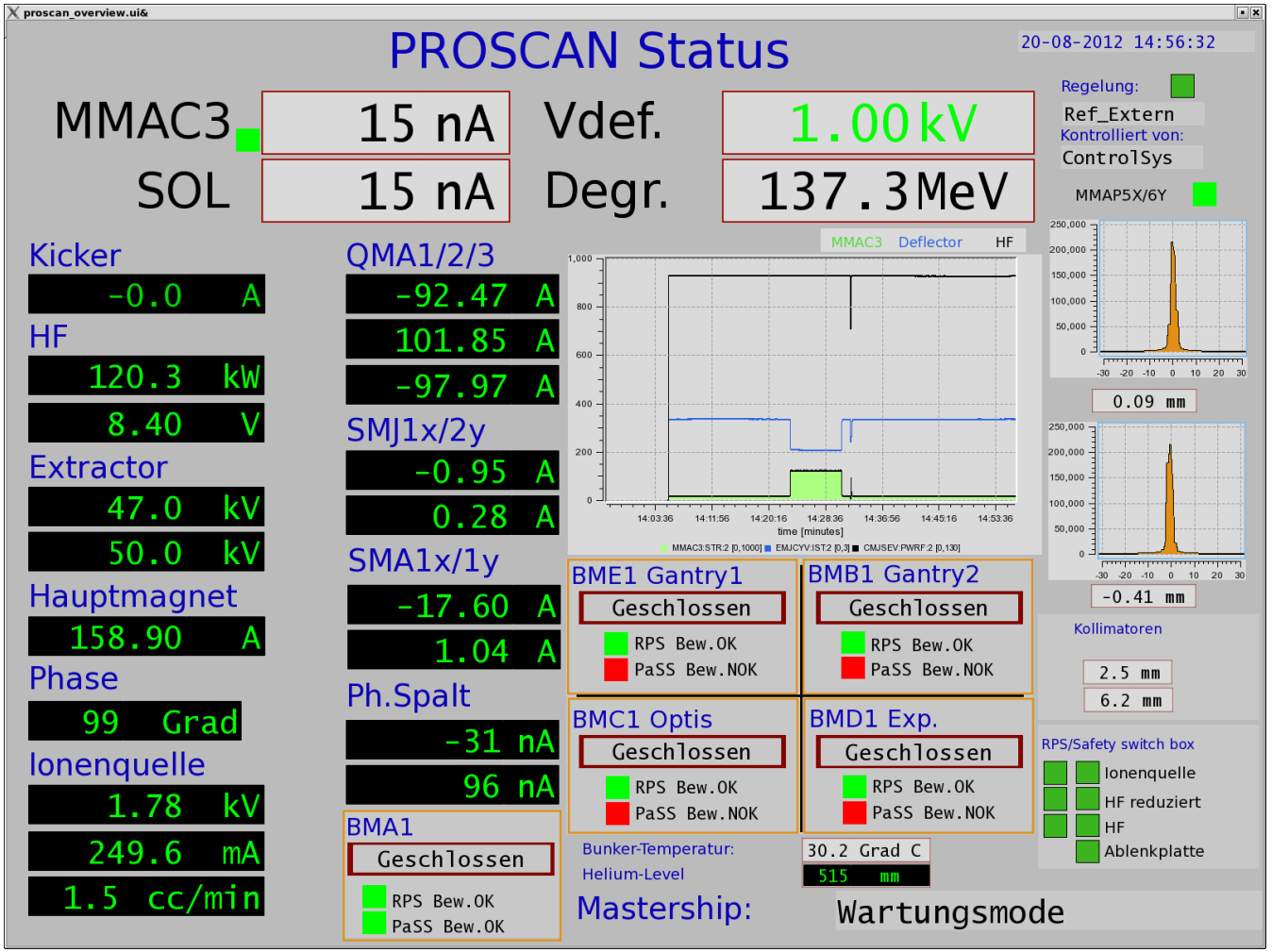
caQtDM Tutorial Introduction

Introduction:

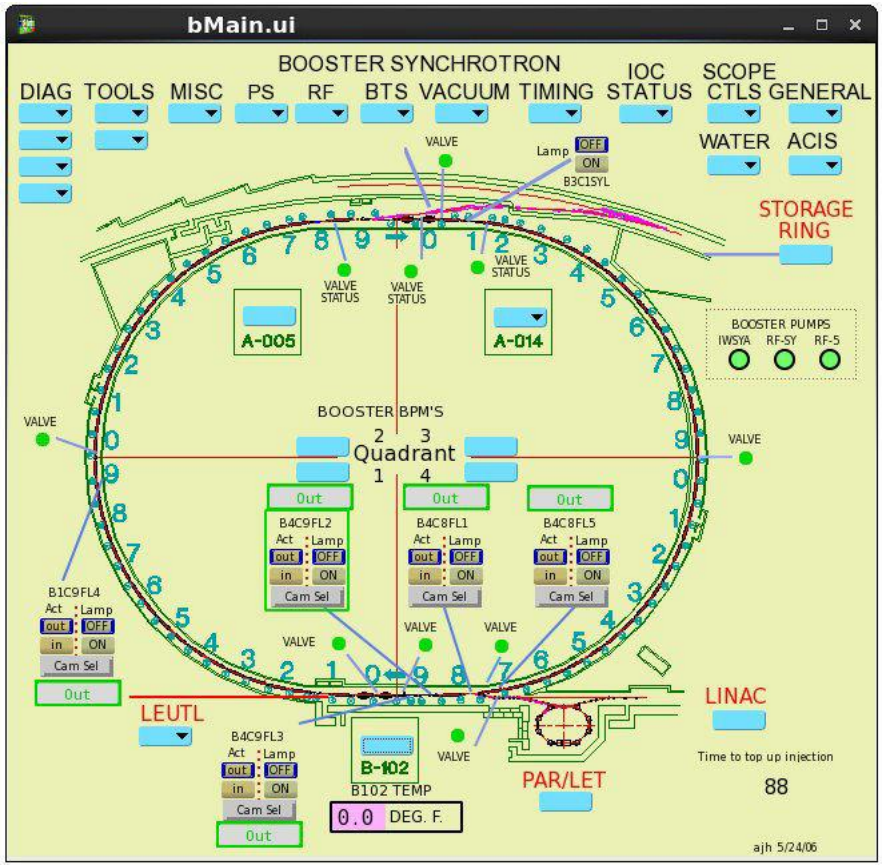
caQtDM “Channel Access Qt Display Manager”

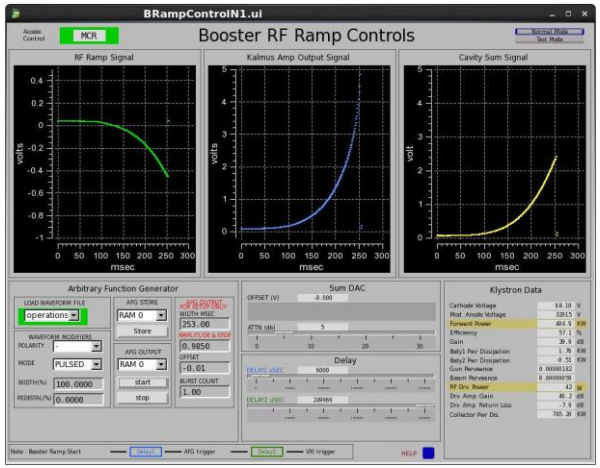
- A graphical user interface (GUI) for creating control screens
- Similar to MEDM (Motif Editor Display Manager)
- Based on Qt, a cross-platform application framework
- Qt started as a widget toolkit, expanded to run non-GUI programs
- Runs on Linux & Windows (no X11 server required)
- Qt is distributed with an open source license
- caQtDM “look & feel” similar to medm; includes medm file converter
- Primary tool used to monitor & control devices using EPICS software

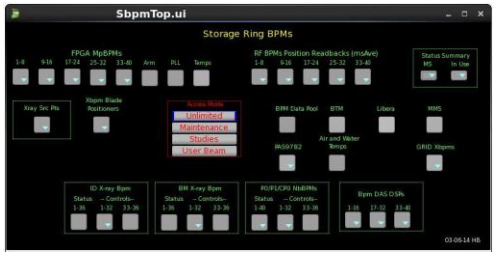
caQtDM Swiss Light Source Display



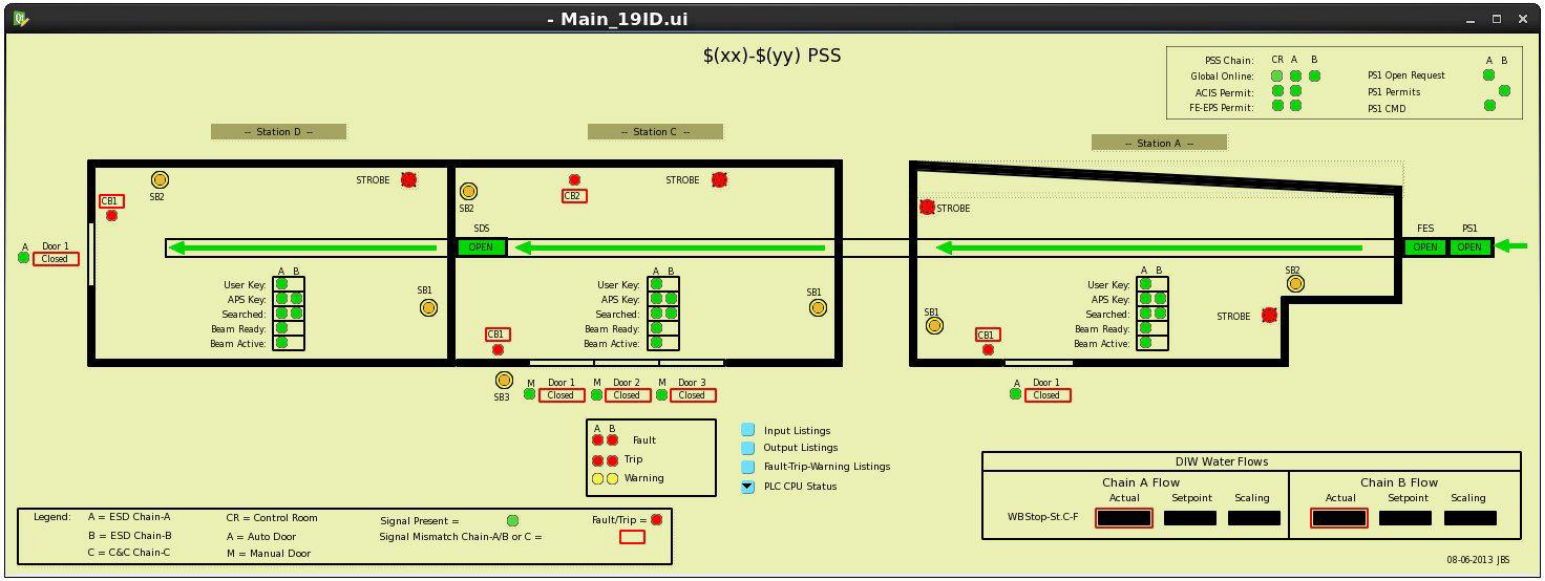
caQtDM Examples







caQtDM Beamline Display



caQtDM Background

- Released February 2012 Paul Scherrer Institute (Swiss Light Source)
- MEDM (Swiss Light Source Control System) GUI
- Anton Mezger, PSI
  - MOTIF & X11 systems/libraries dated, difficult to add new features
  - Qt is a modern GUI widget toolkit based on C++
  - Incorporate all existing MEDM widgets into caQtDM
  - Convert existing MEDM adl files into XML based *.ui format
- Qt Designer
  - Editor called “Designer”
  - Tool For Creating Displays
- caQtDM
  - Viewer
  - Used to run a display in execute mode

caQtDM Environment Variables

Environment Variables

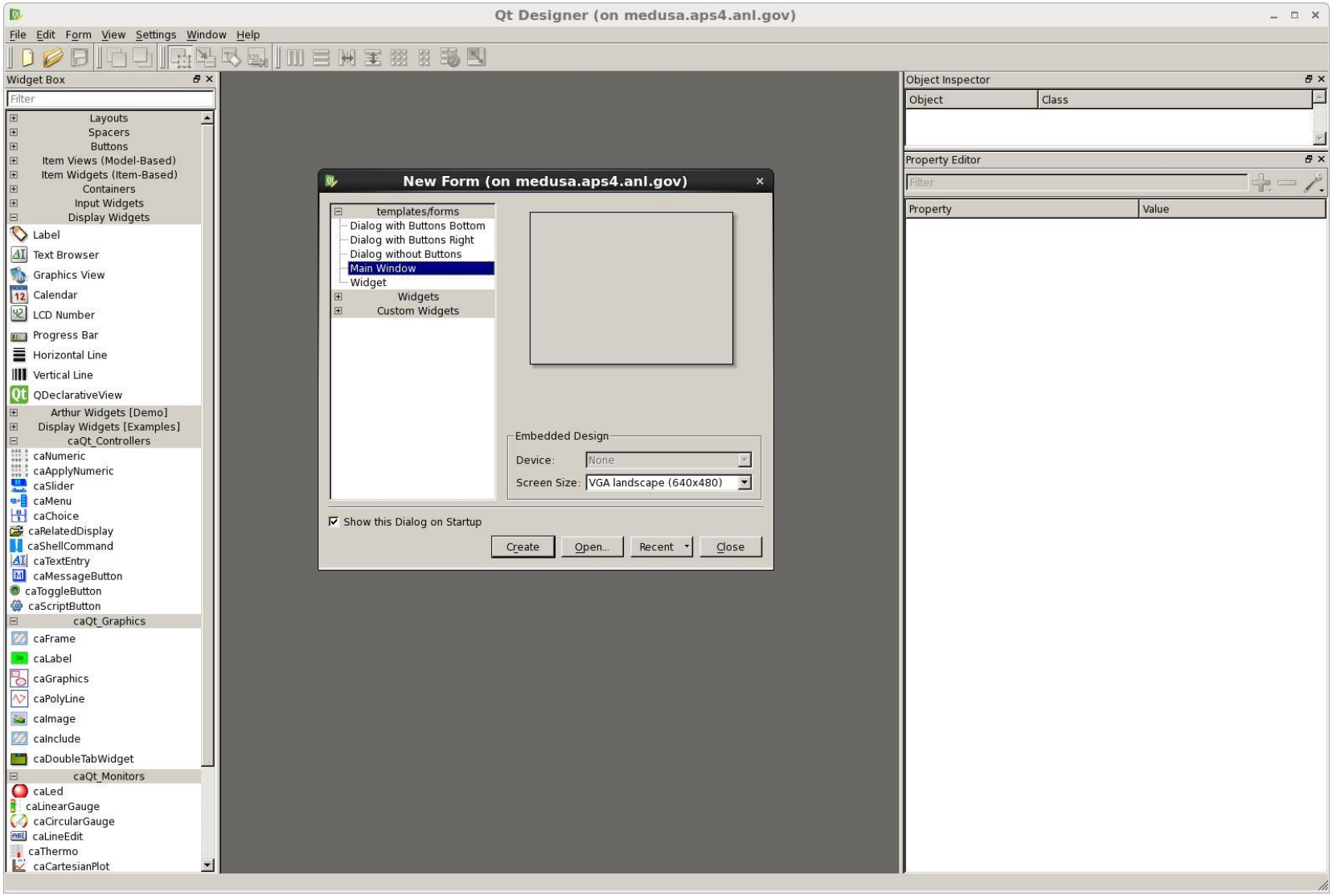
- CAQTDM_DISPLAY_PATH
  - Set path to *.ui files, ~caQtDM/parser, ~caQtDM-3.6.4/caQtDM_Tests
- QT_PLUGIN_PATH
  - ~caQtDM/caQtDM-3.6.4/caQtDM_Binaries
- EPICS_CA_MAX_ARRAY_BYTES
  - The maximum number of **bytes** transferred for an array.
  - This should be >= the definition in the IOC.
- /APSshare/caqtdm
  - HowToUse.txt
  - Shell Scripts

Creating caQtDM Displays

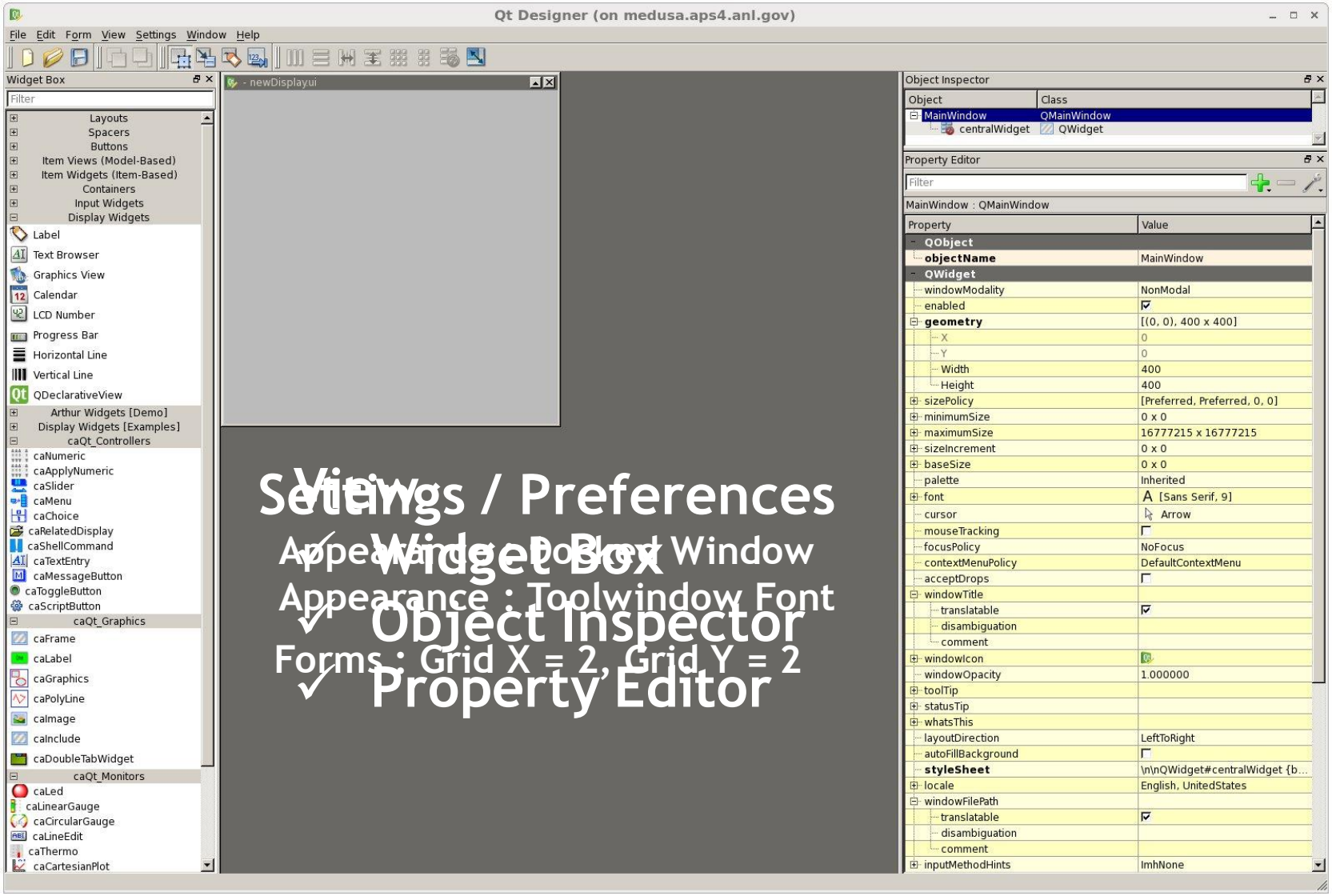
Convert, Create, & Run

- Create MEDM Display
- Convert MEDM adl file to caQtDm ui file
  - ~caQtDM-3.6.4/caQtDM_Binaries/adl2ui *.adl
- Edit caQtDM *.ui Display
  - ~caQtDM/packages/qt-everywhere-opensource-src-4.8.5/bin/designer
- Run caQtDM Display
  - ~caQtDM/caQtDM-3.6.4/caQtDM_Binaries/caQtDM

caQtDM Designer

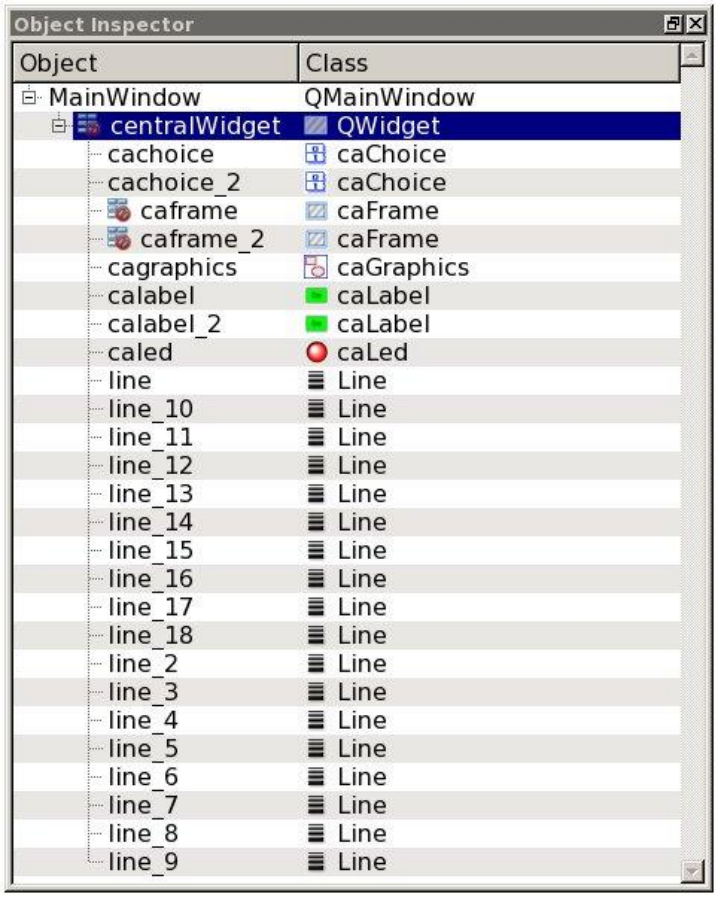


caQtDM Designer



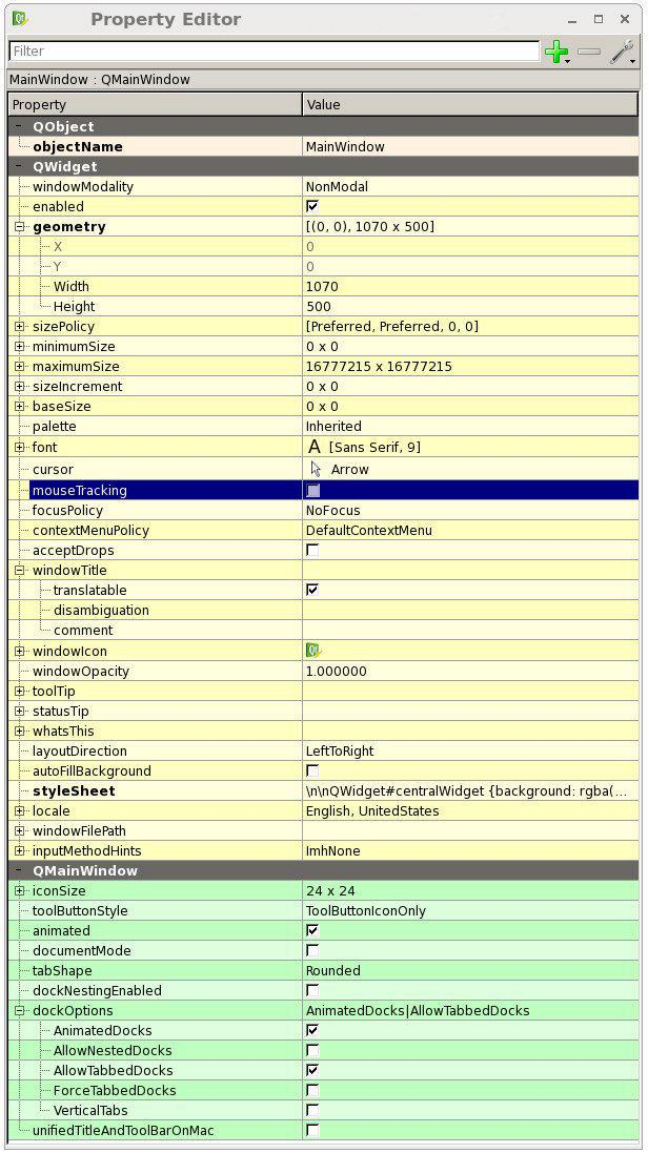
caQtDM Object Inspector

- Shows Hierarchical List of Objects
- MainWindow
  - Parent Class of the Control Display
- centralWidget
  - Define Main Window Background Color
- Widgets
  - Object Assigned Number
  - Class Defined by Type



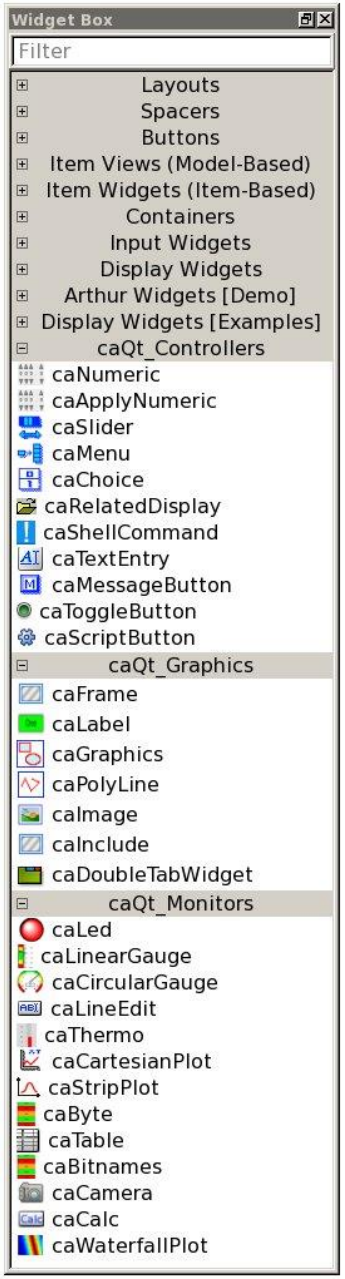
caQtDM Designer Property Editor

- Each widget has a set of properties
- The properties are chosen via the Property Editor
- All widgets have
  - X and Y Position
  - Height and Width
- Others vary depending on the object
- Assign Property Values
  - Channel (PV name)
  - Color Mode (static/alarm)
  - Visibility
  - Max/Min Range
  - Direction



caQtDM Designer Widget Box

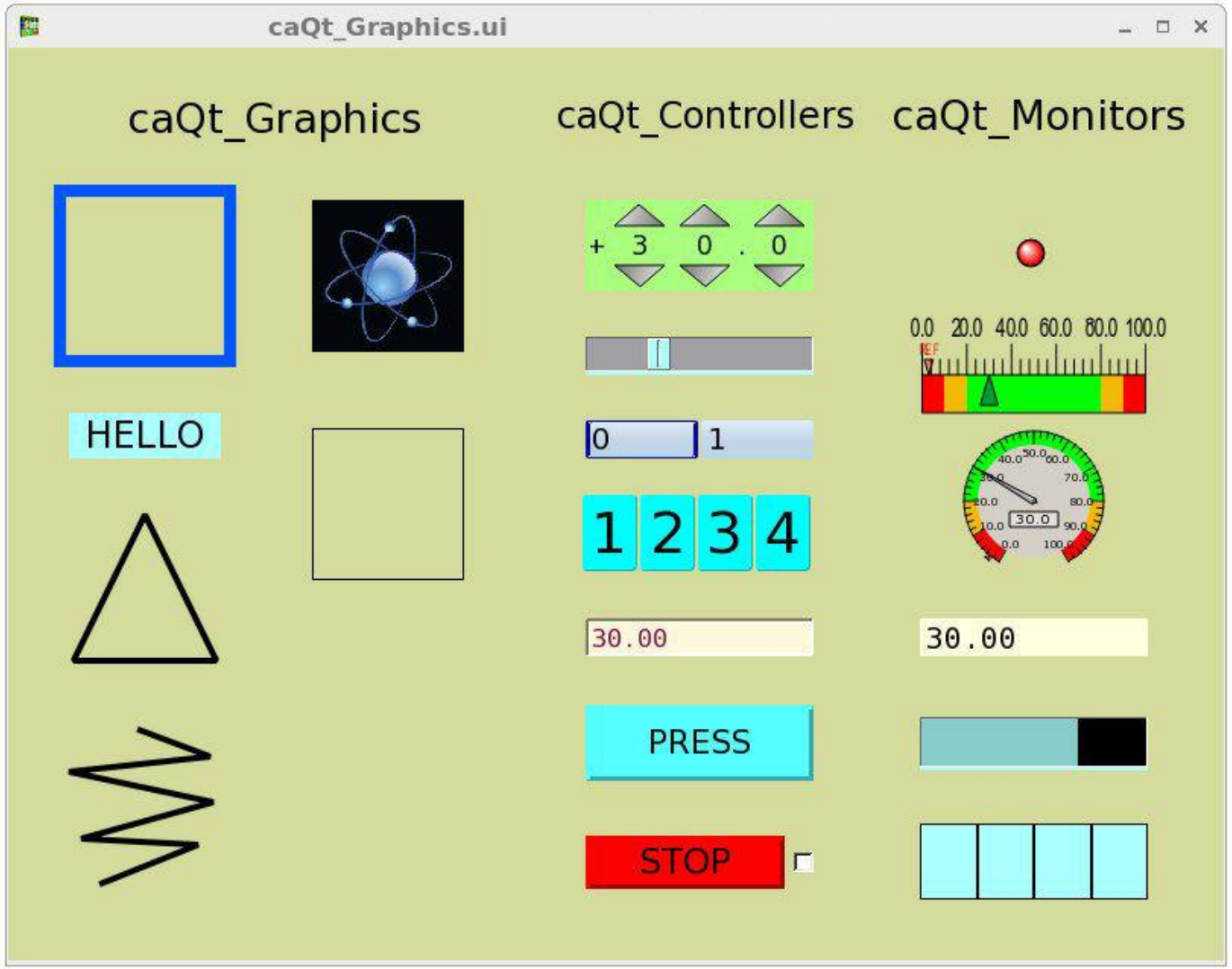
- CA Widgets Divided Into Three Categories
- Controllers
  - Send a value (caPut)
- Monitors
  - Read a value (caGet)
- Graphics
  - Circle, Square, Triangle
  - Polyline
  - Visibility based on Value, CALC, Alarm
- Display Widgets (Fourth Widget Type)
  - Passive (No Channel Access)
  - Horizontal Line
  - Vertical Line



caQtDM Widgets

Graphics	Monitors	Controllers	Display
caFrame	caLed	caNumeric	Horz. Line
caLabel	caLinearGage	caApplyNumeric	Vert. Line
caGraphics	caCircularGage	caSlider	Label
caPolyline	caThermo	caChoice	Calendar
caImage	caCartesianPlot	caRelatedDisplay	Progress Bar
caInclude	caStripPlot	csShellCommand	
caDoubleTabWidget	caByte	caTextEntry	
	caTable	caMessageButton	
	caBitnames	caToggleButton	
	caCamera	caScriptButton	

caQtDM Widgets

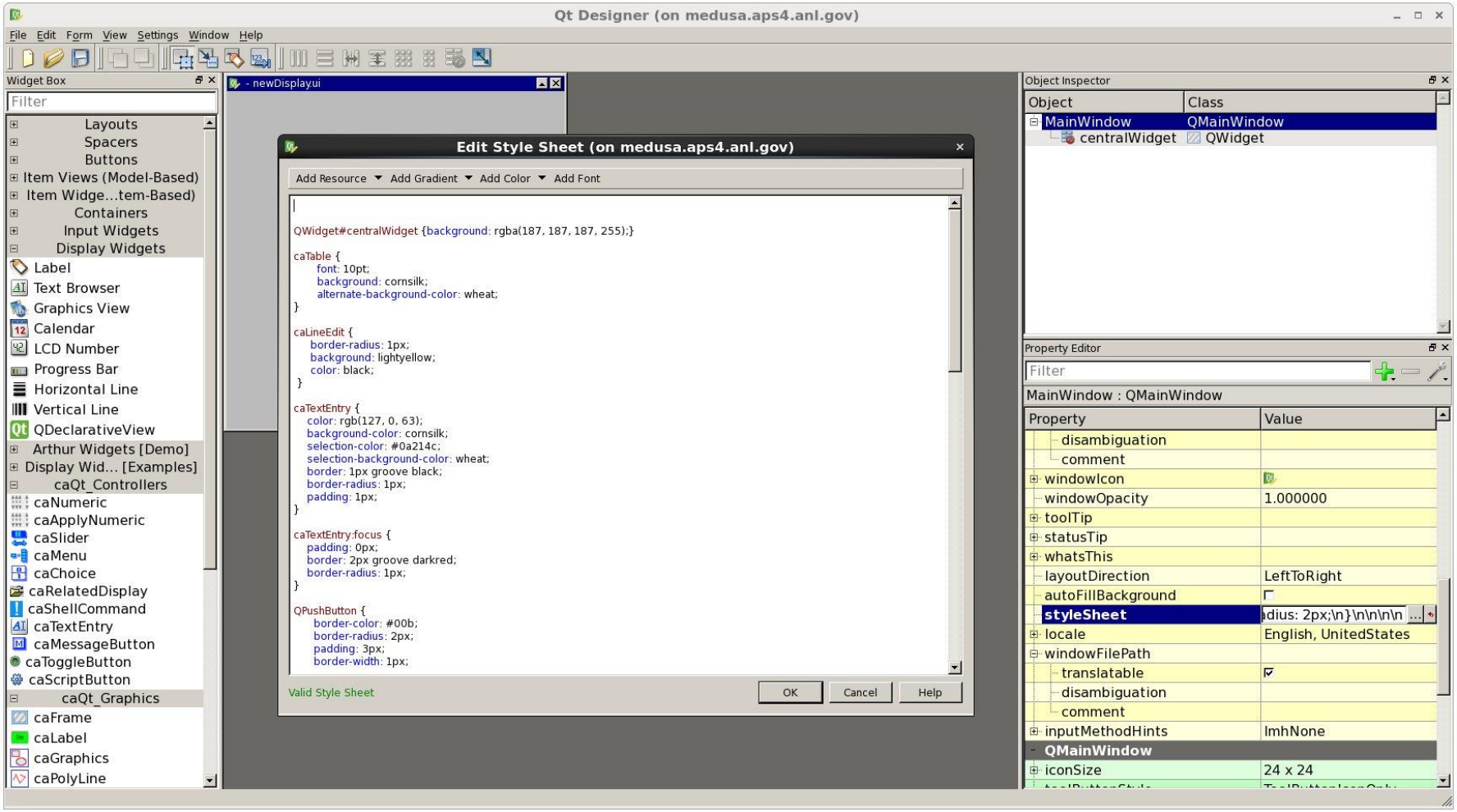


caQtDM Style Sheet

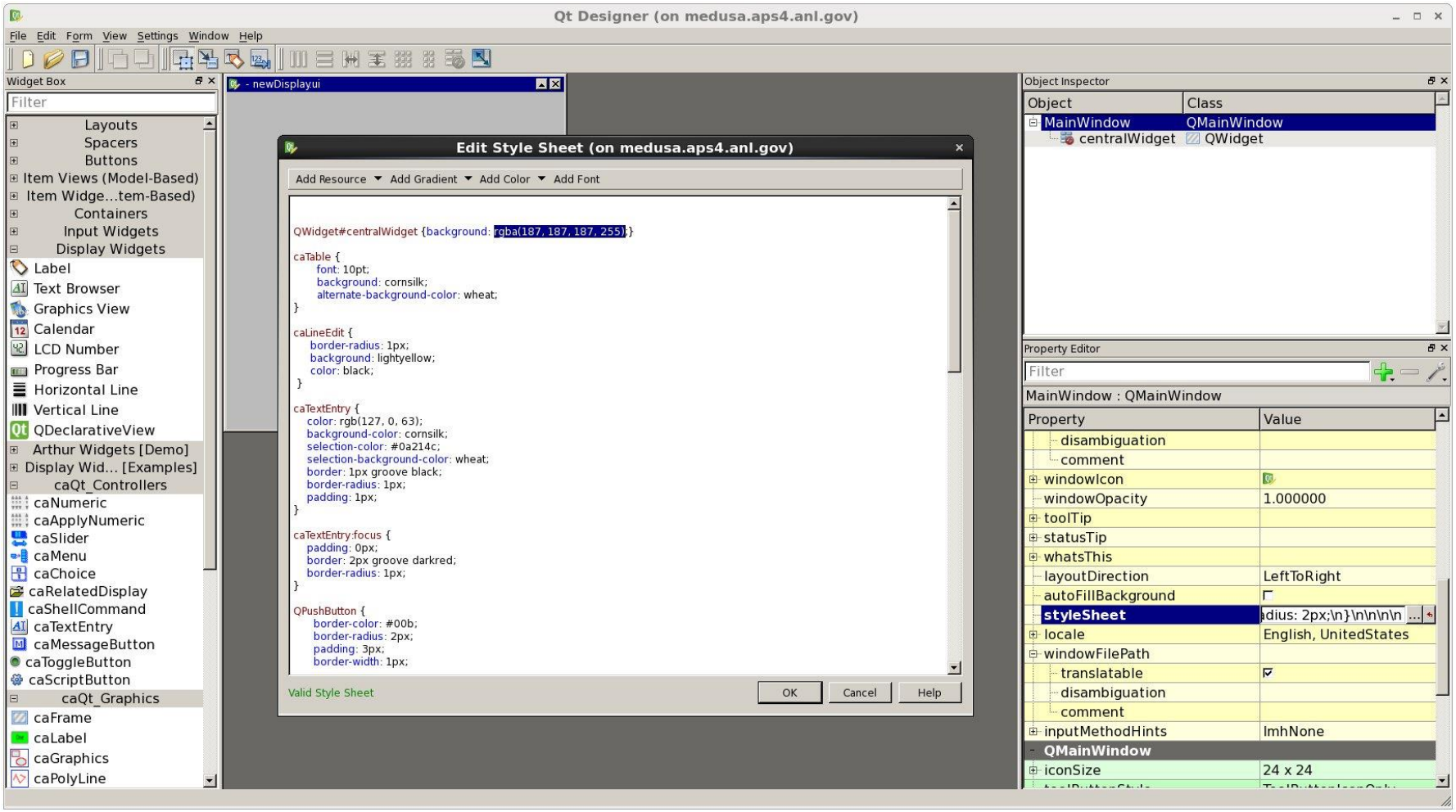
Designing Custom Widgets

- Used To Define Attributes of Widgets
- Foreground Color, Background Color, Font Size, etc.
- Style Sheet based on HTML Cascading Style Sheets (CSS)
- Default Style Sheet Assigned to “parentobject” of the control display
- Define Standard Attributes of EPICS “Channel Access” Widgets
- Can Load Style Sheet From A Local Directory Defined by caQtDM Path
- Some Attributes of Widgets Overwritten

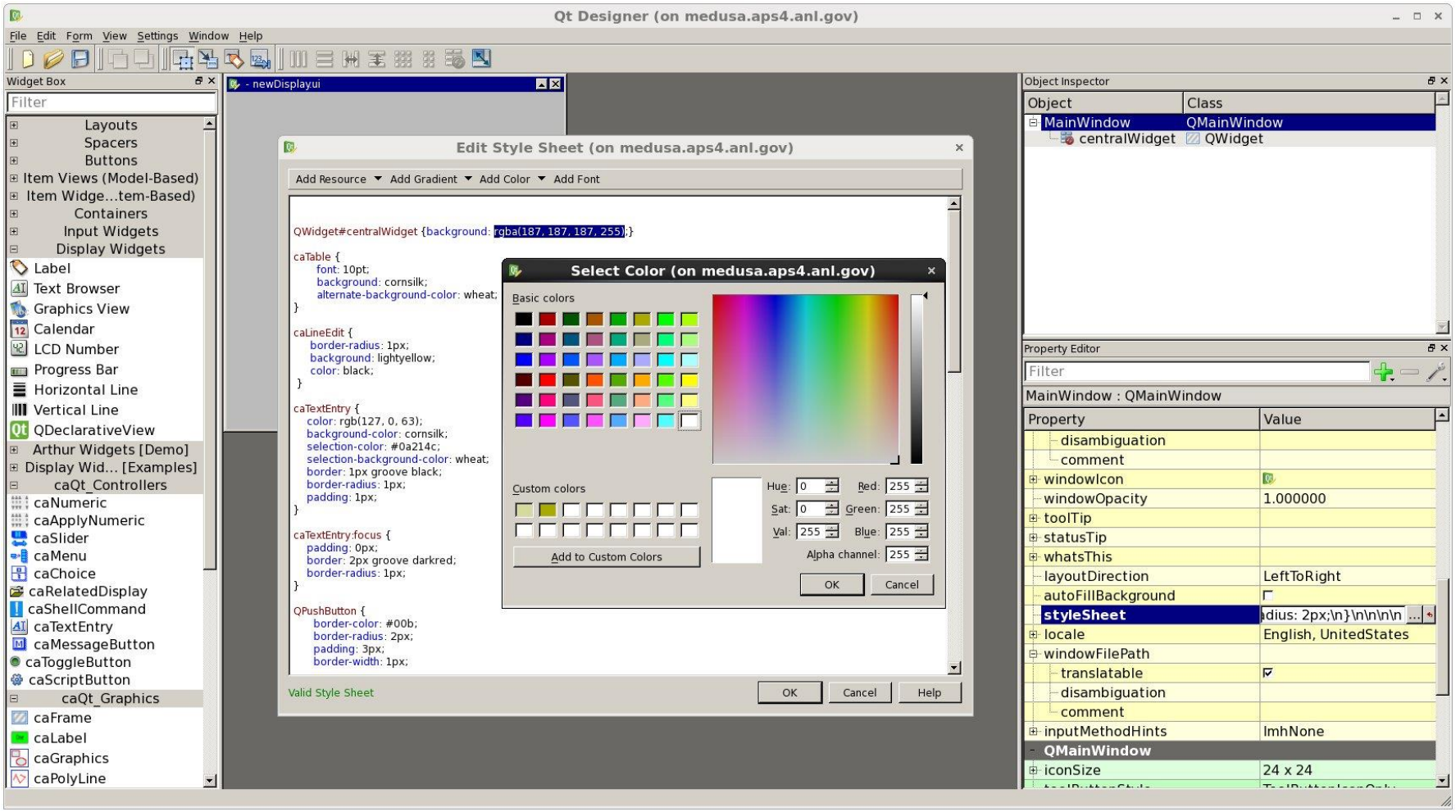
caQtDM Style Sheet



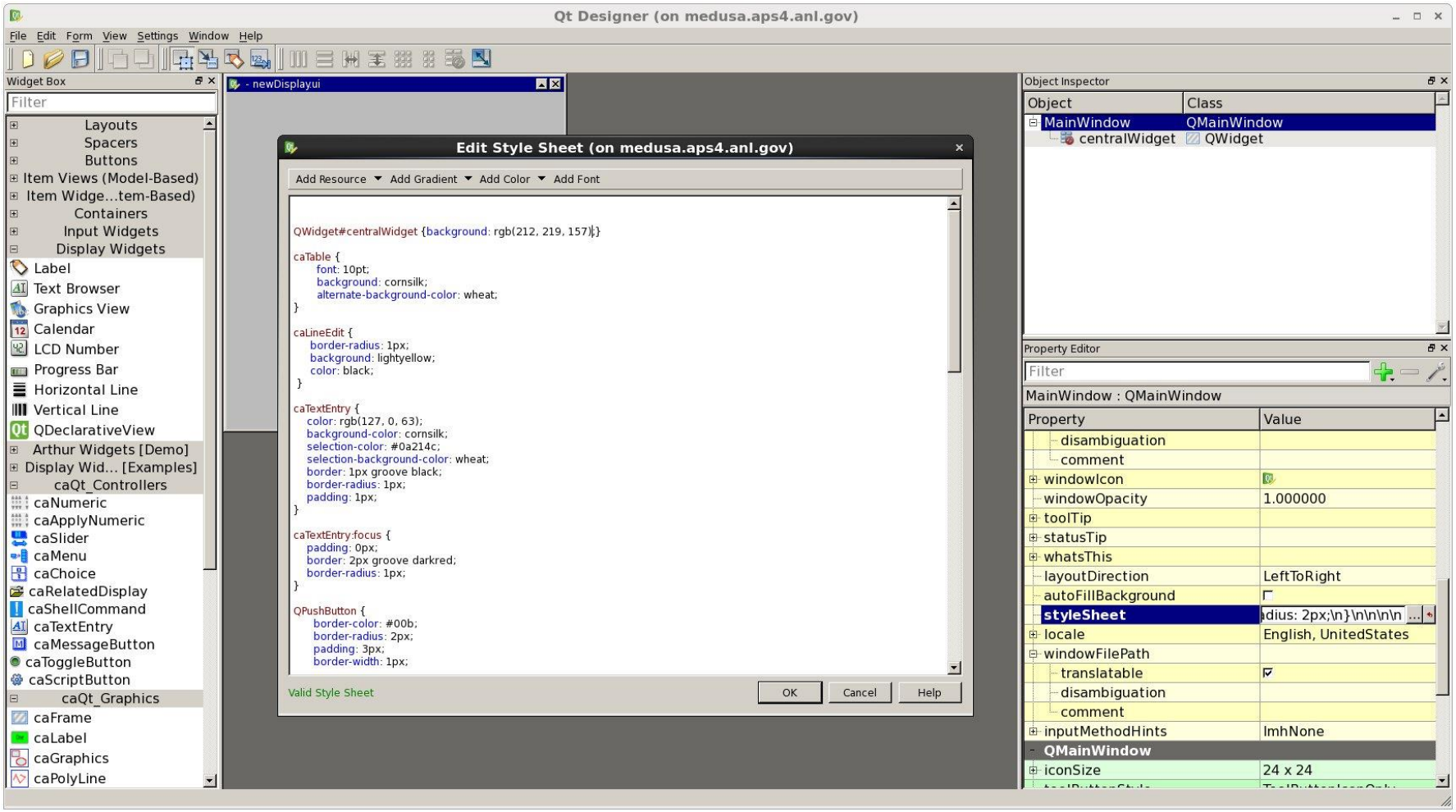
caQtDM Style Sheet



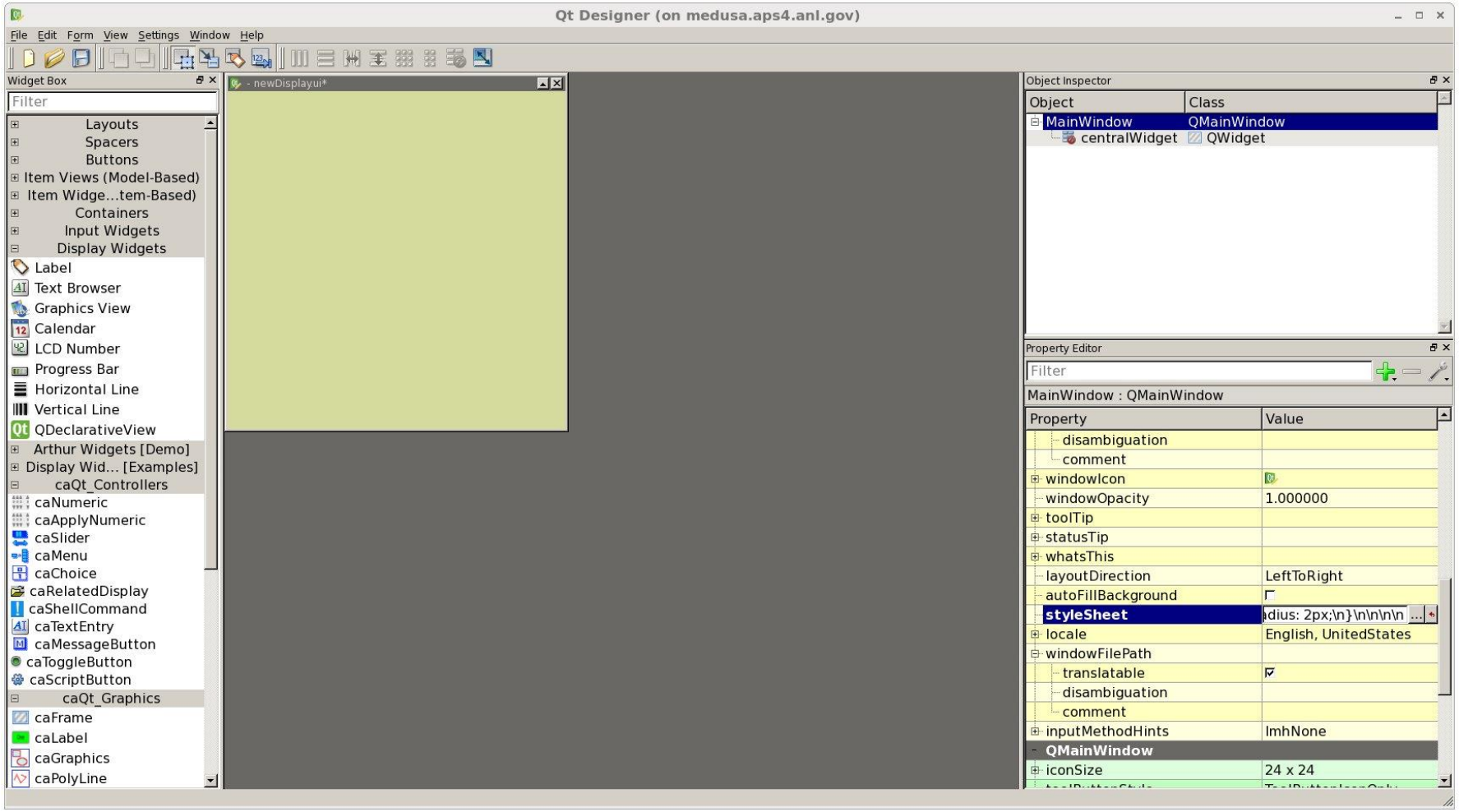
caQtDM Style Sheet



caQtDM Style Sheet



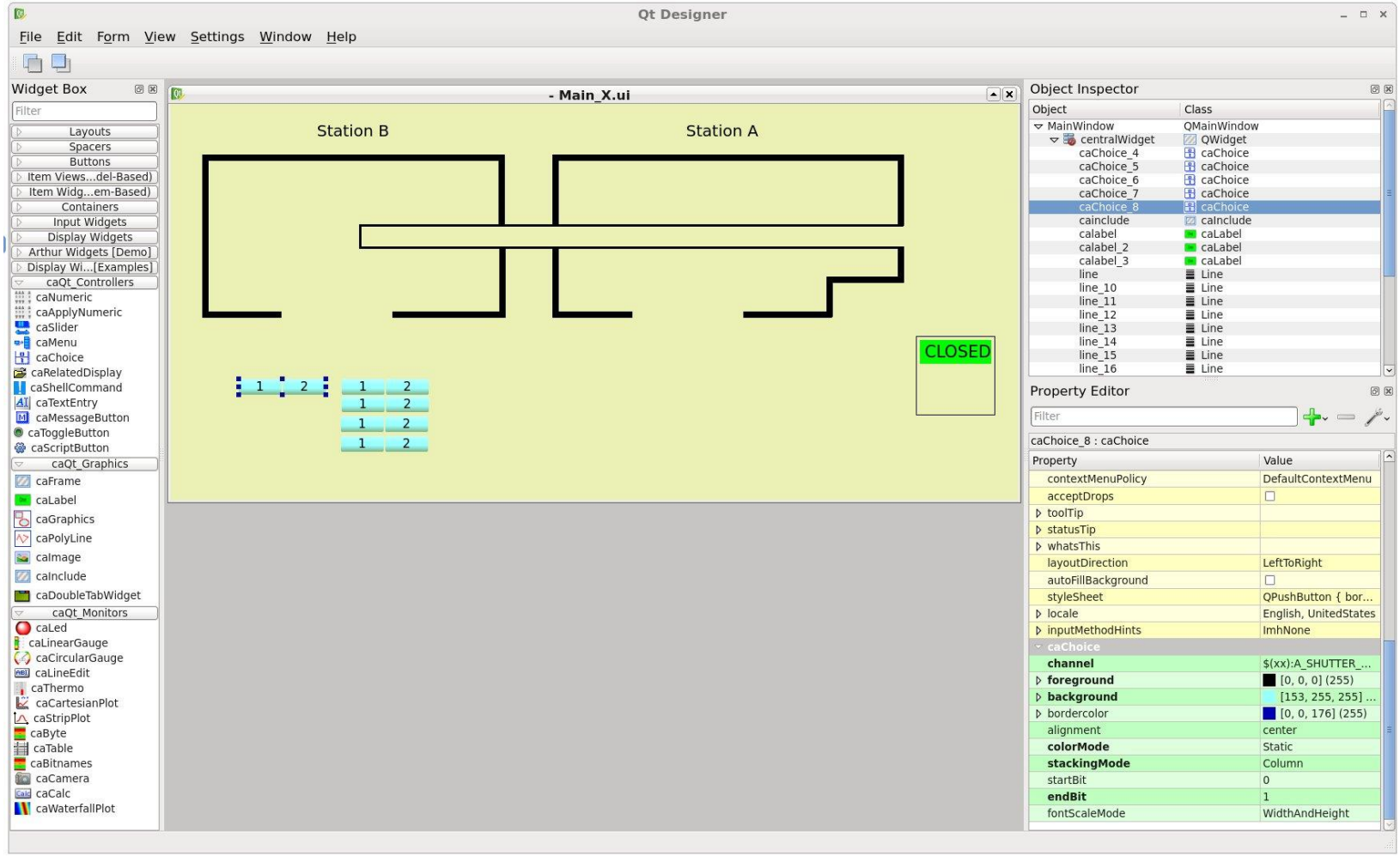
caQtDM Style Sheet



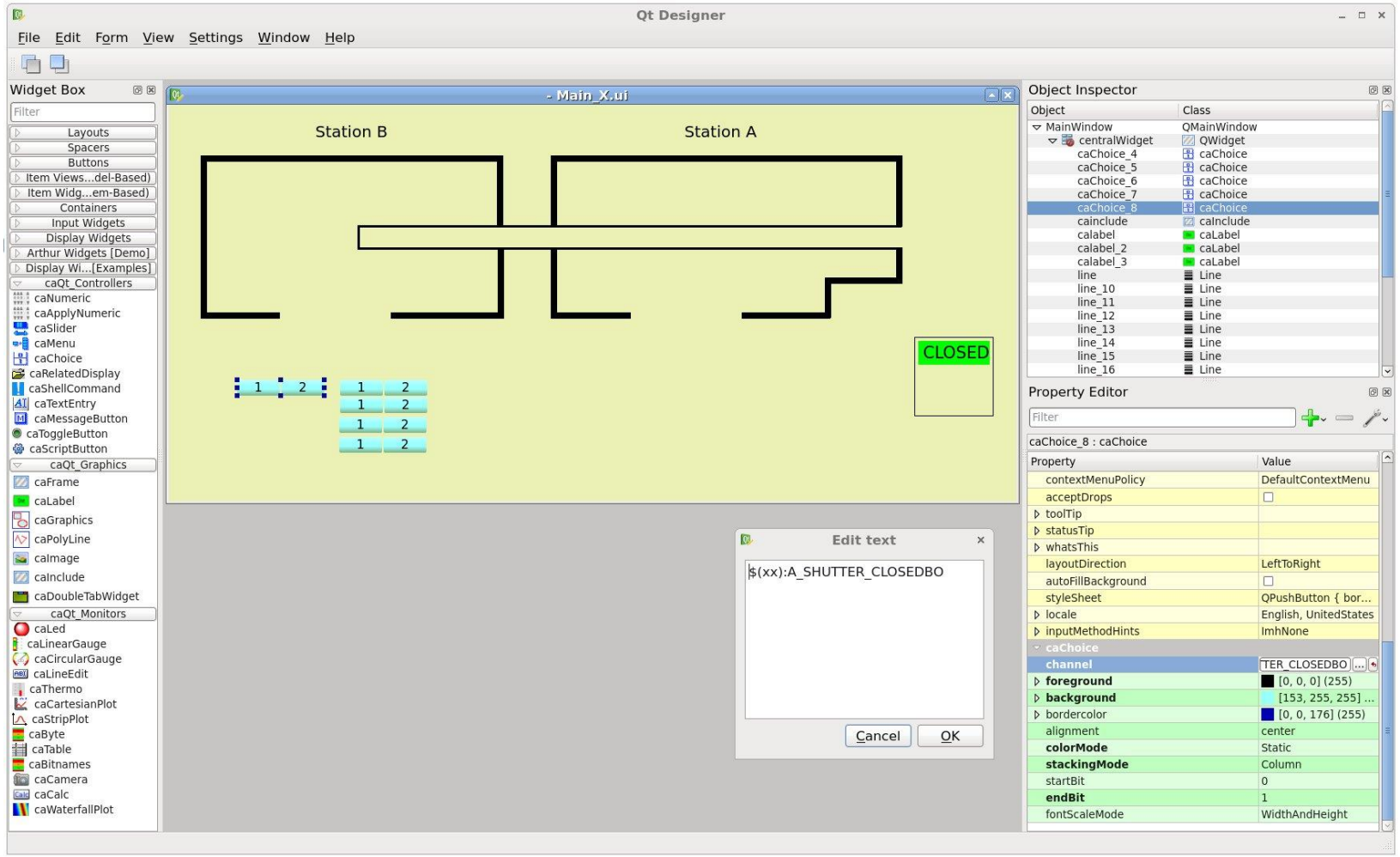
caQtDM Designer Editing

- Drag & Drop Widgets
- Left Click To Select Widget
  - Widget “objectName “ Property Editor
- Right Click On Widget For Edit Menu Functions
  - Cut, Copy, & Paste
- Tiled Widgets
  - Send To Back, Bring To Front
- Use Arrow Keys To Move Widget
- Standard File Functions
  - Open, Close, & Save
- Edit Undo/Redo Buffer

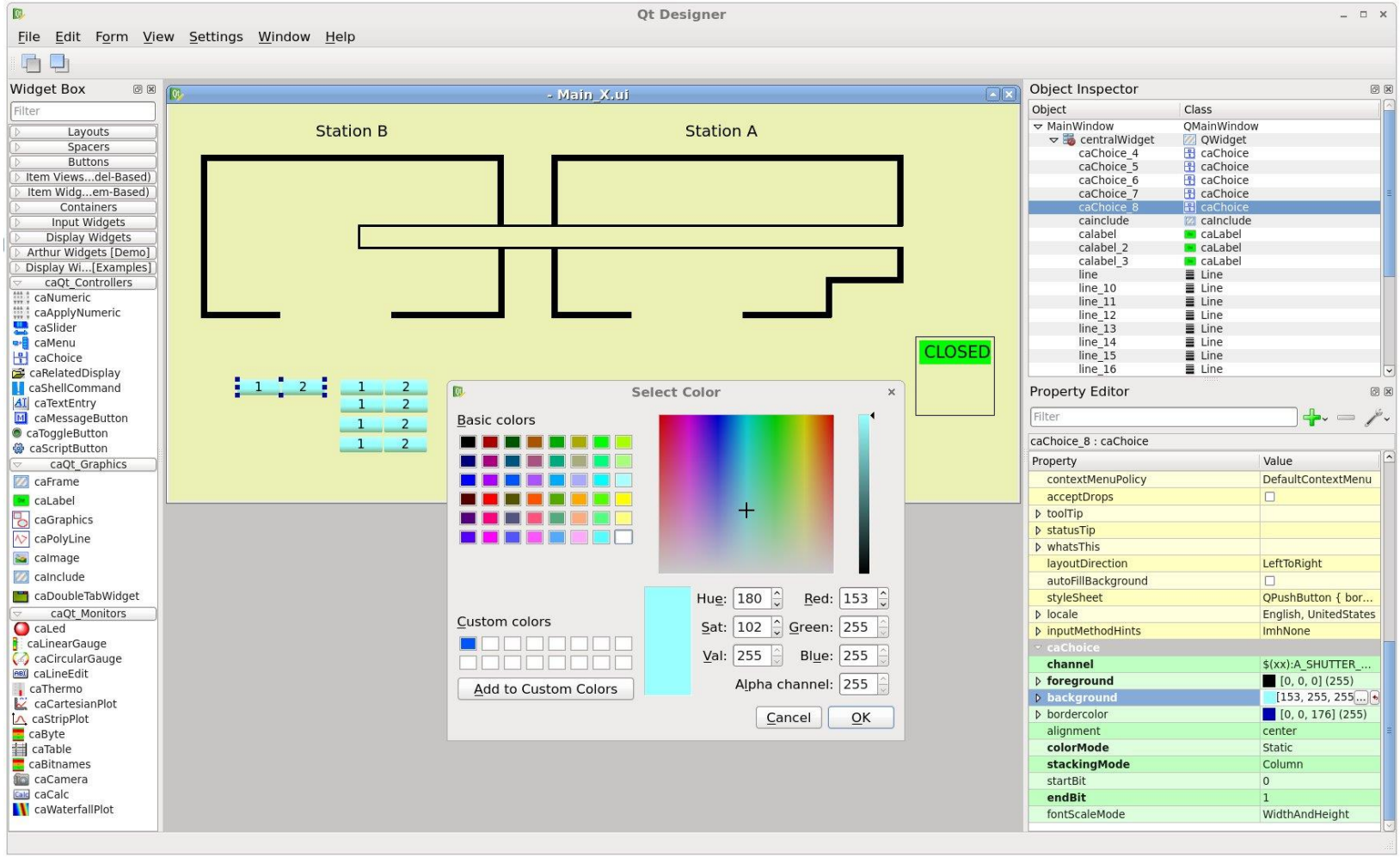
caQtDM Designer Editing



caQtDM Designer Editing



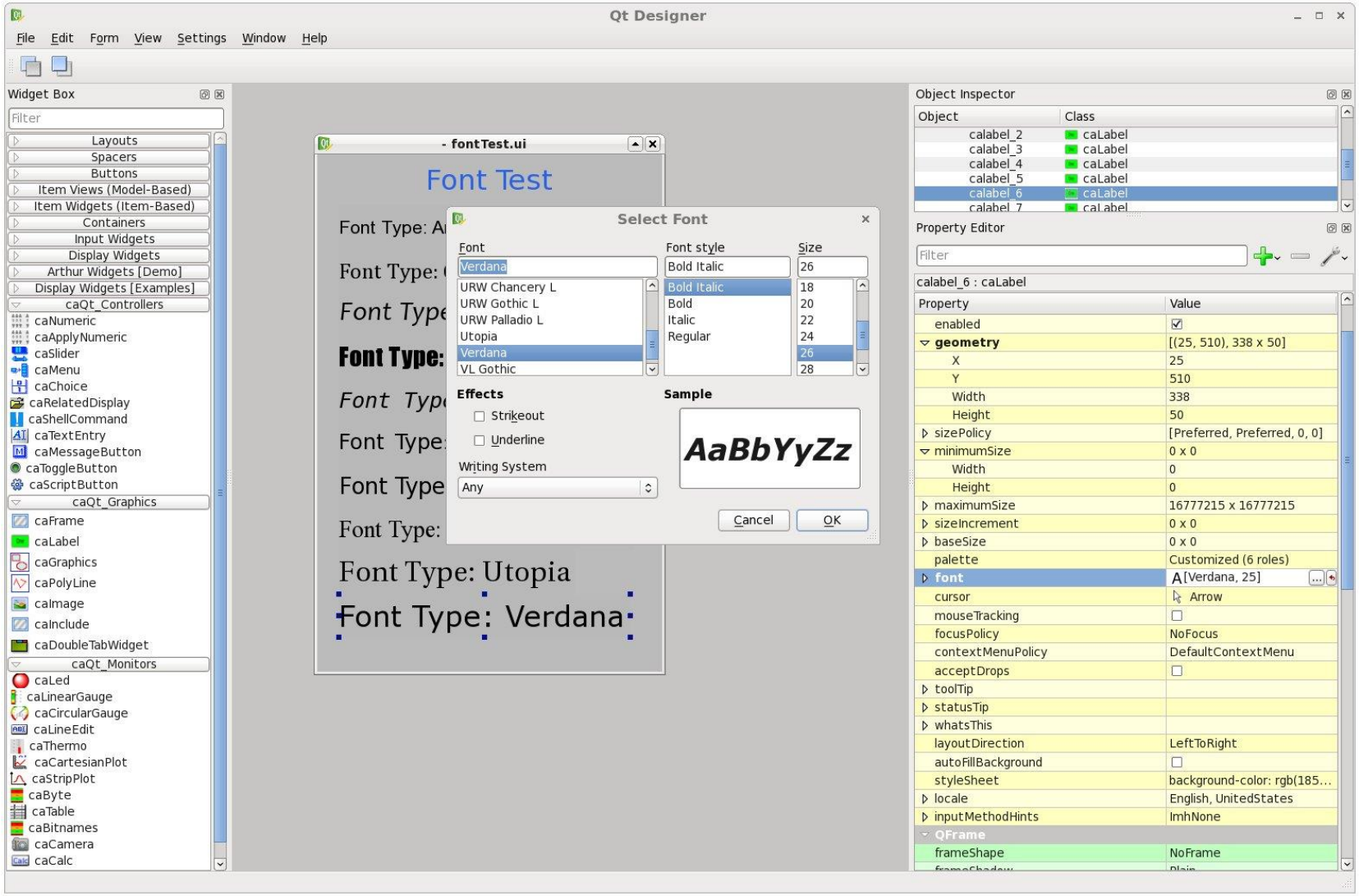
caQtDM Designer Editing



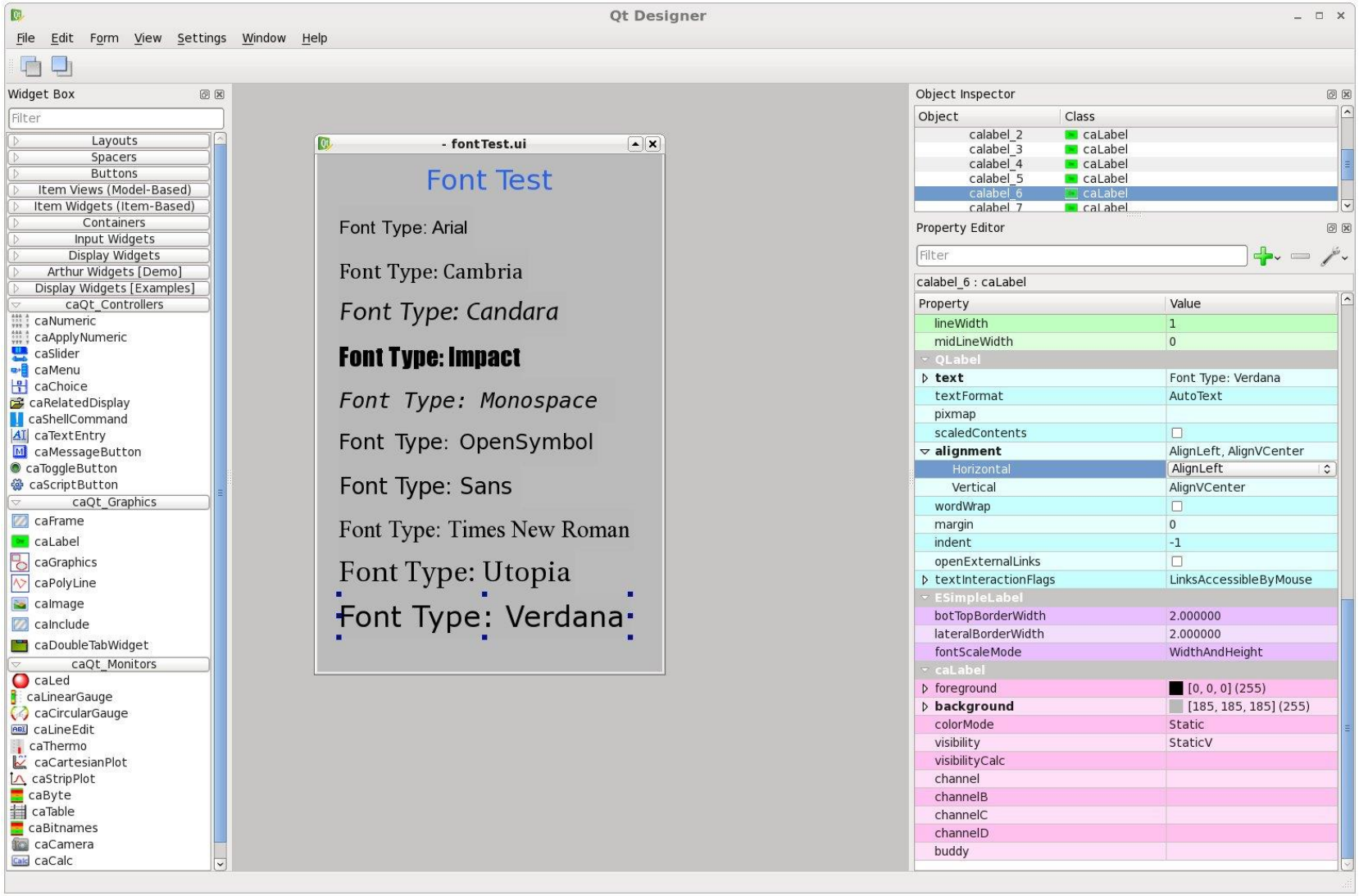
caQtDM Fonts

- **caQtDM Uses Scalable Fonts**
- **caLabel & caLineEdit Widgets**
  - caLabel = Text Widget
  - caLineEdit = Text Monitor (readback)
- **fontScaleMode**
  - “None” = No Scaling
  - “Height” = Text Scaled to Height
  - “Width & Height” = Used For Correct Resizing of Display
  - Default Setting = “Width & Height”
- **The font size is determined by the height of the text box**
  - The text cannot extend beyond the box horizontally
  - In practice you vary it until it looks right

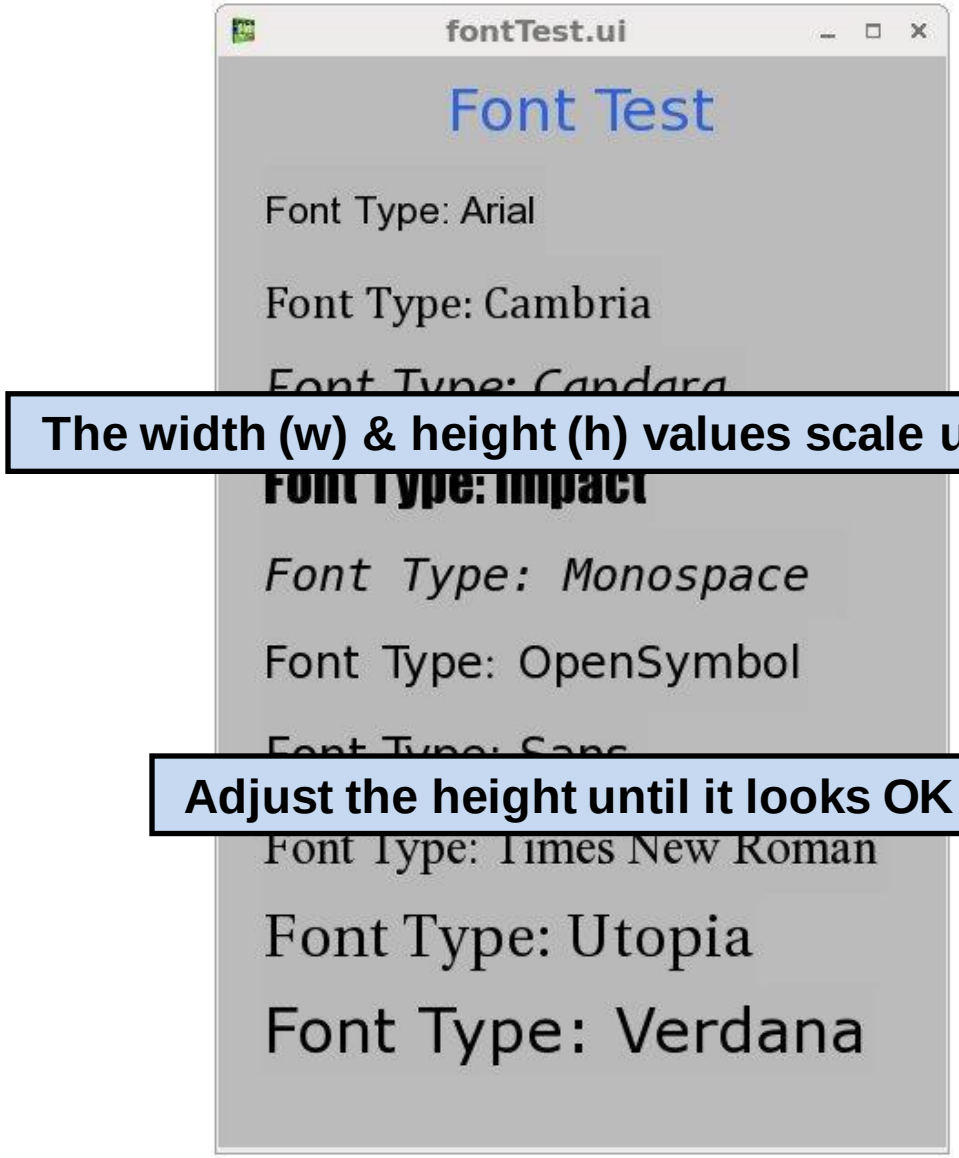
caQtDM Font Selection



caQtDM Font Alignment



caQtDM Scalable Fonts

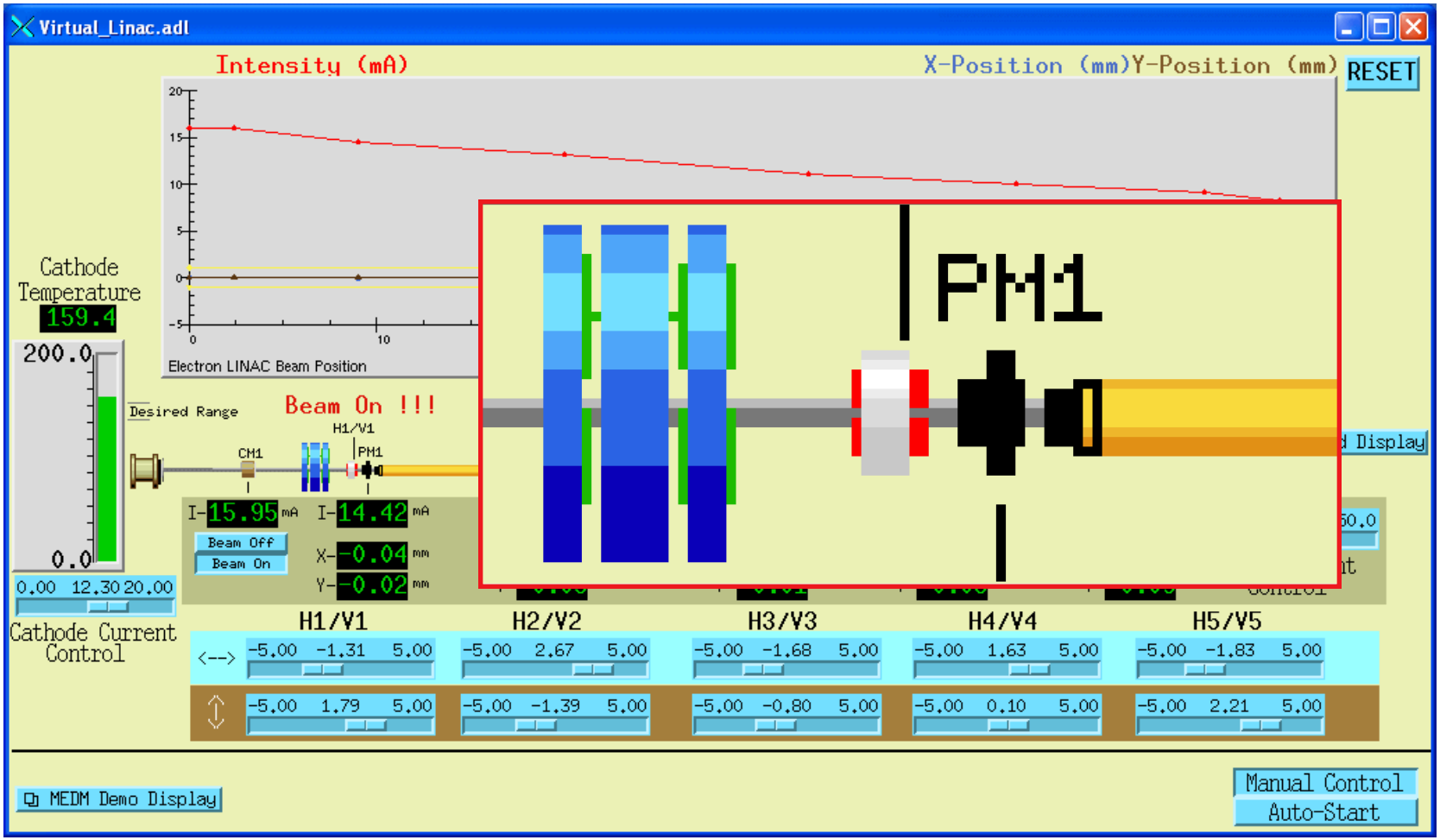


The width (w) & height (h) values scale uniformly

Adjust the height until it looks OK

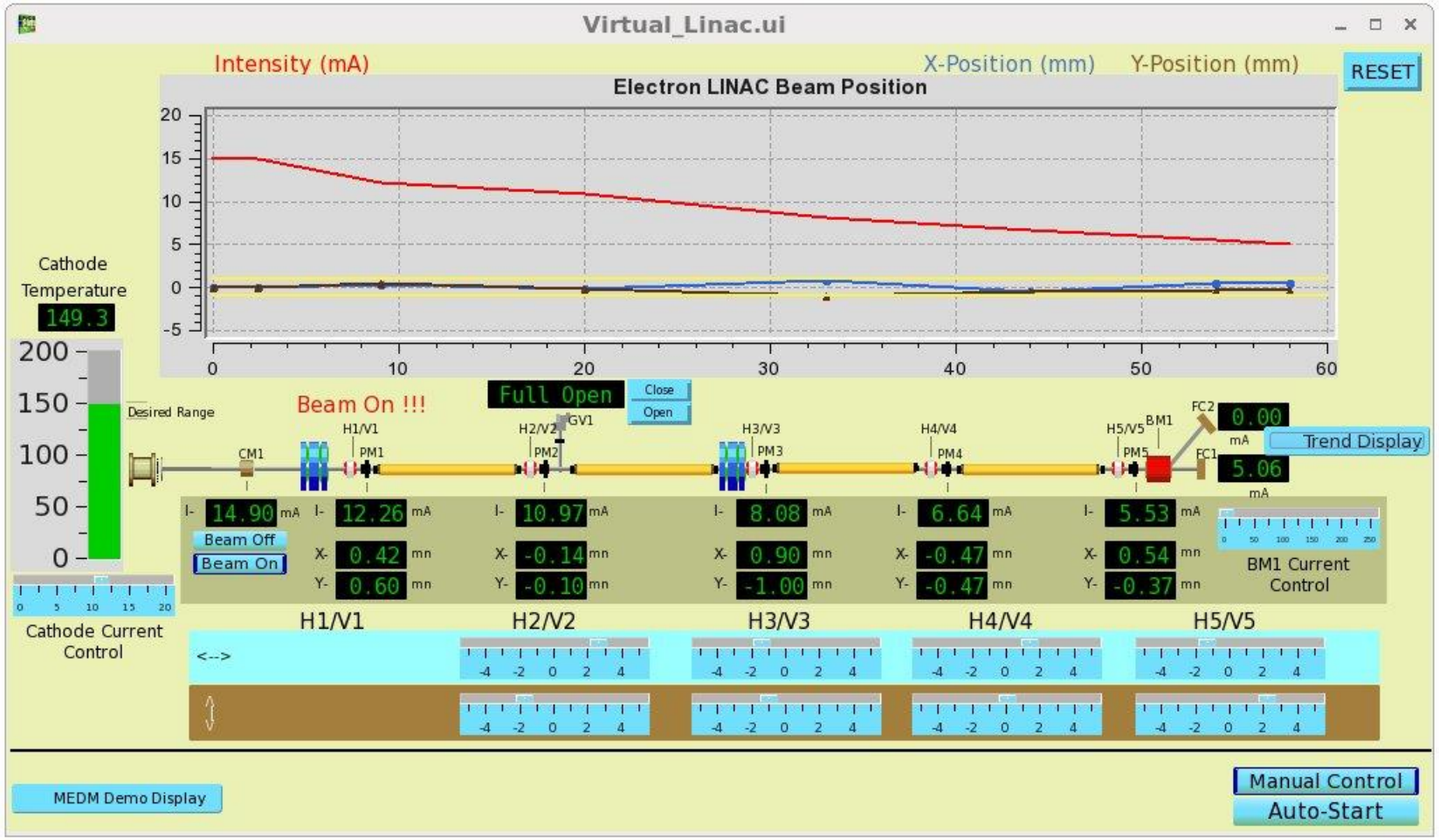
medm Graphics Objects

- **Many effects are created with Graphics objects**



caQtDm Virtual Linac Display

- **Same effects are created with Graphics Widgets**

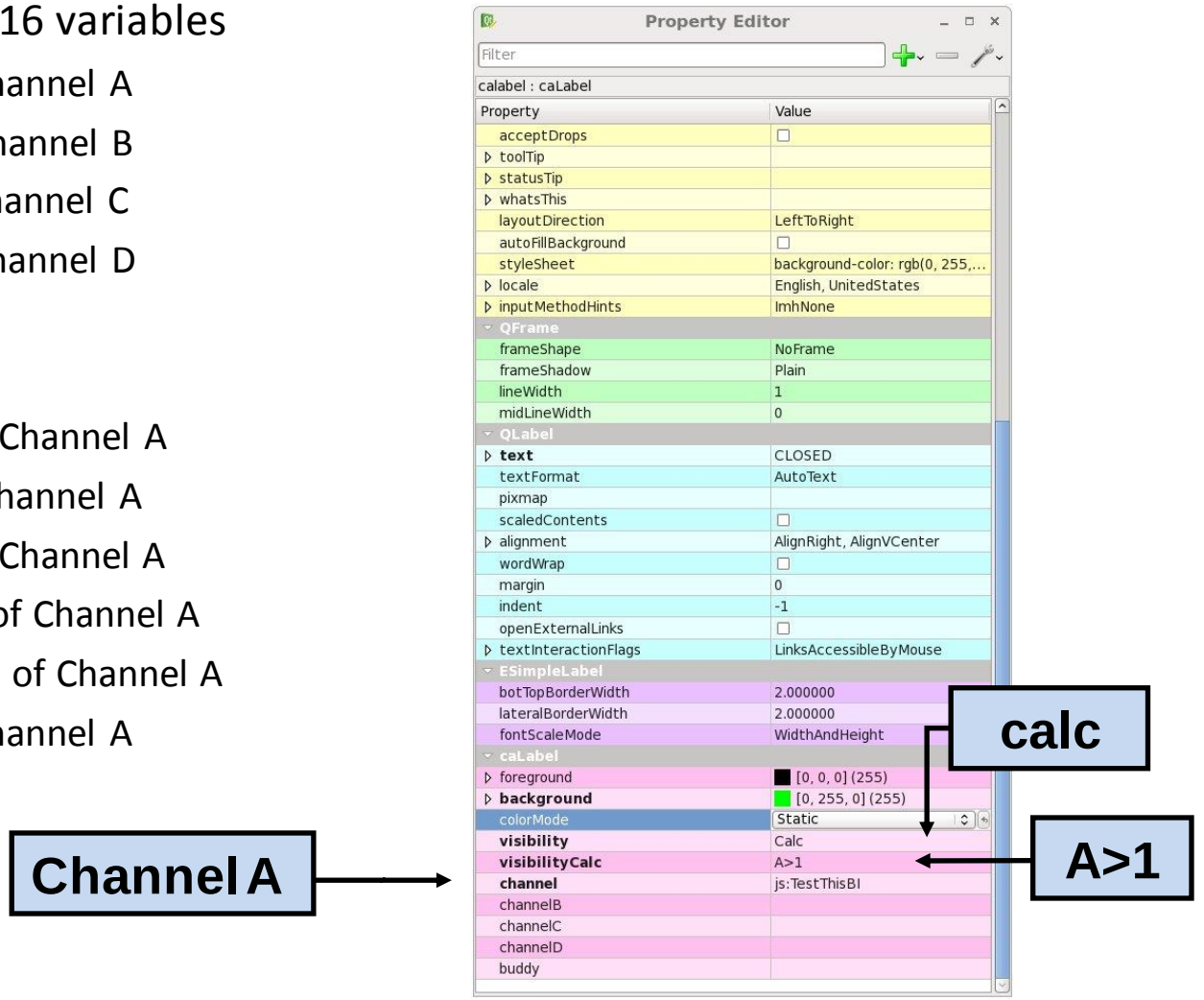


caQtDM Dynamic Attribute

- **Applies Primarily to Graphics Widgets**
- **Objects with a Dynamic Attribute can have their color or visibility change based on process variables or conditions**
- **Color Mode (Static/Alarm)**
  - Object has alarm colors (Green, Yellow, Red)
- **Visibility Mode**
  - Visible only if the process variable is zero or only if not zero
- **Visibility Calc Mode**
  - Visibility is based on a CALC expression involving up to 4 process variables plus HOPR, LOPR, STAT, SEVR, etc.

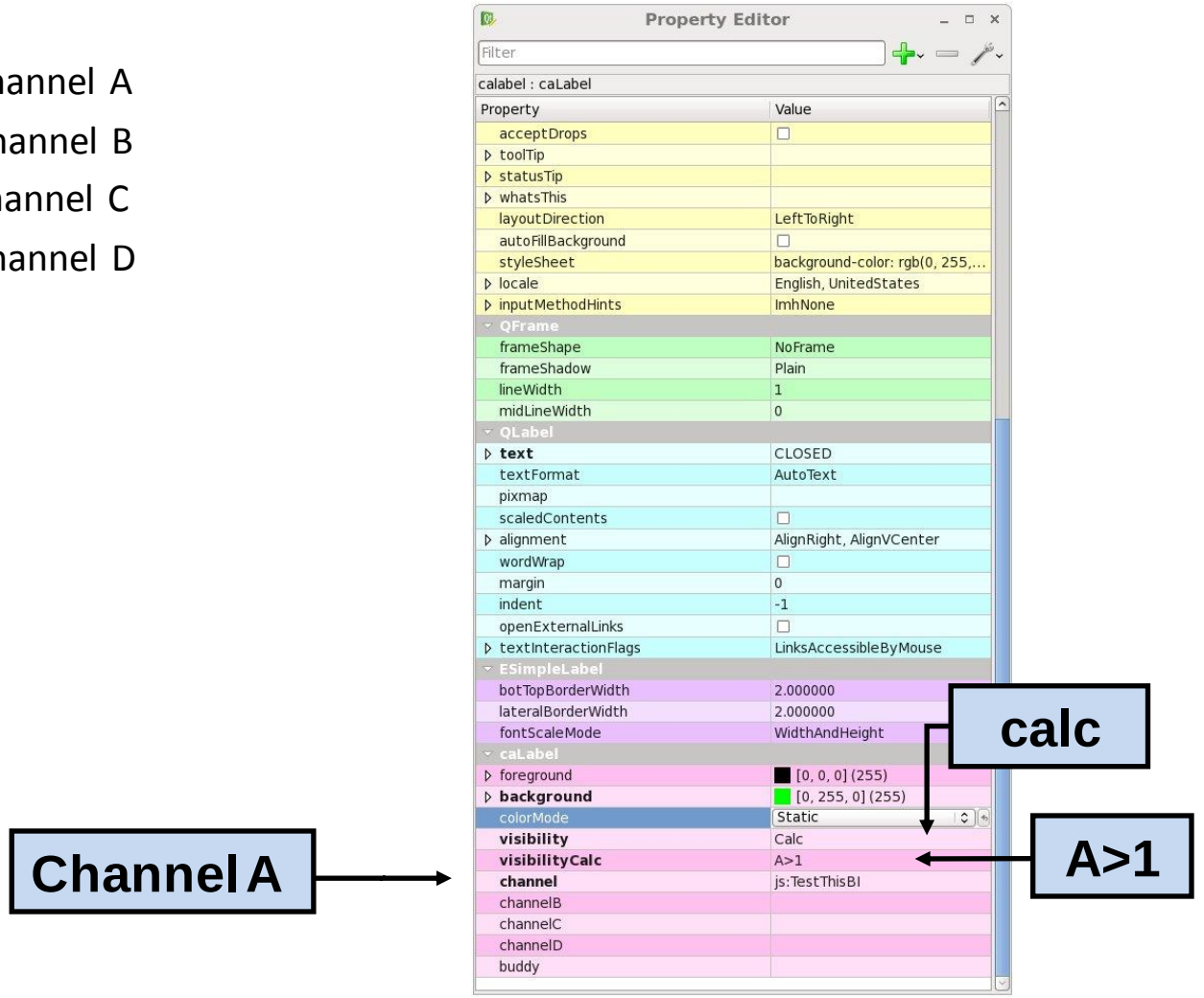
caQtDM Calc Expression

- Expression involving 16 variables
  - A The value of Channel A
  - B The value of Channel B
  - C The value of Channel C
  - D The value of Channel D
  - E Reserved
  - F Reserved
  - G The COUNT of Channel A
  - H The HOPR of Channel A
  - I The STATUS of Channel A
  - J The SEVERITY of Channel A
  - K The PRECISION of Channel A
  - L The LOPR of Channel A



caQtDM Calc Expression

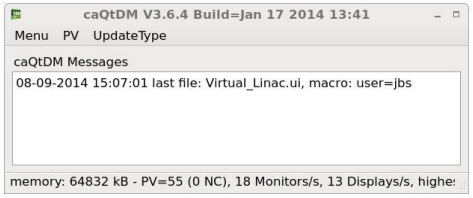
- Expression
  - A The value of Channel A
  - B The value of Channel B
  - C The value of Channel C
  - D The value of Channel D



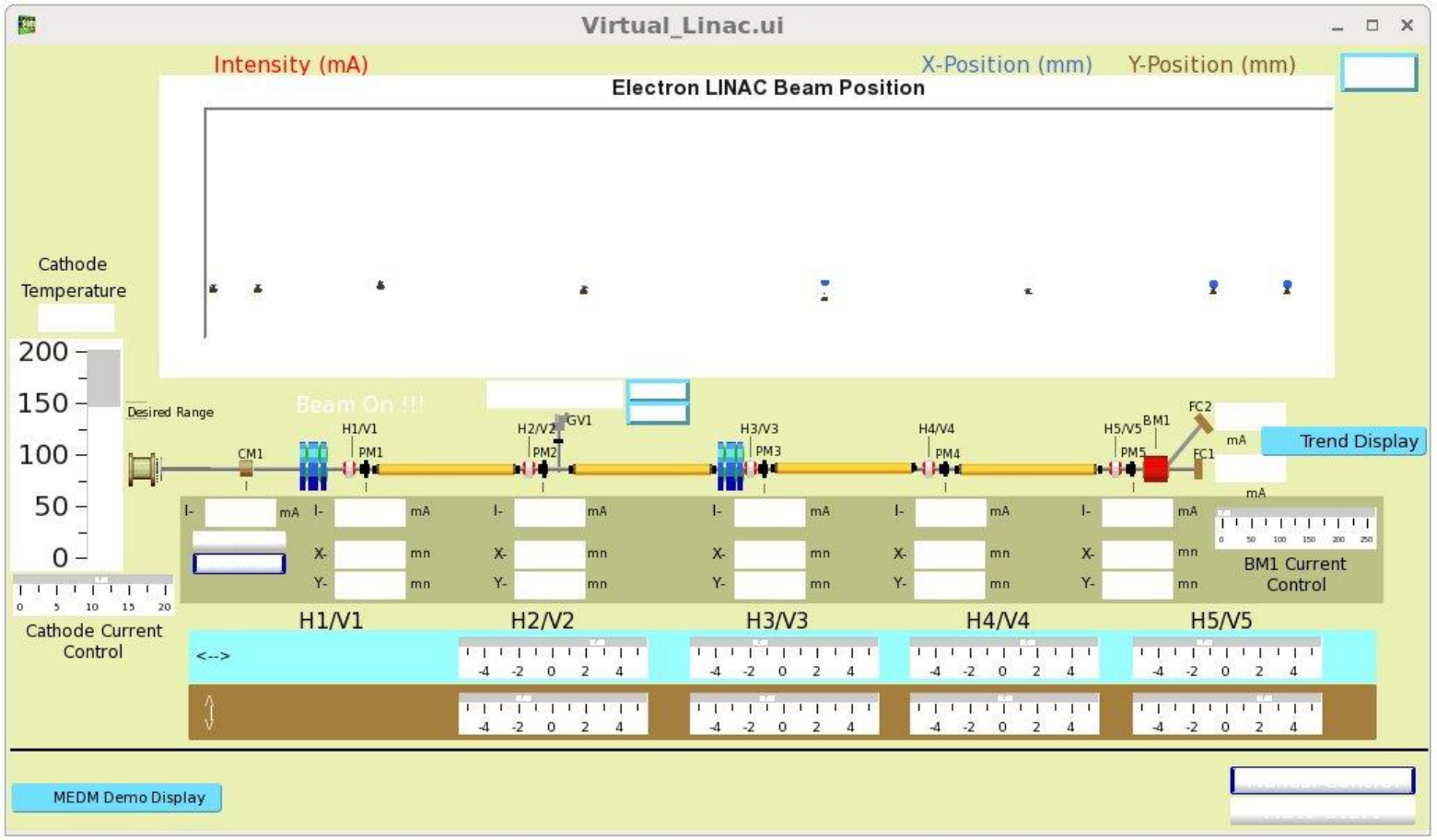
caQtDM Calc Expressions

- **Syntax is the same as for the EPICS CALC record**
  - See the Record Reference Manual
- **Some True/False Examples (for Visibility)**
  - !A Value is zero (Same as "if zero")
  - A Value not zero (Same as 'if not zero")
  - A=12 (or A==12) Value is 12
  - A#12 (or A!=12) Value is not 12
  - A<0&&B<0&&C<0 All are negative
  - A>.9*H Beyond 90% of upper limit
  - !J SEVERITY is not zero

caQtDM Execute Mode



- **What's wrong with this screen?**



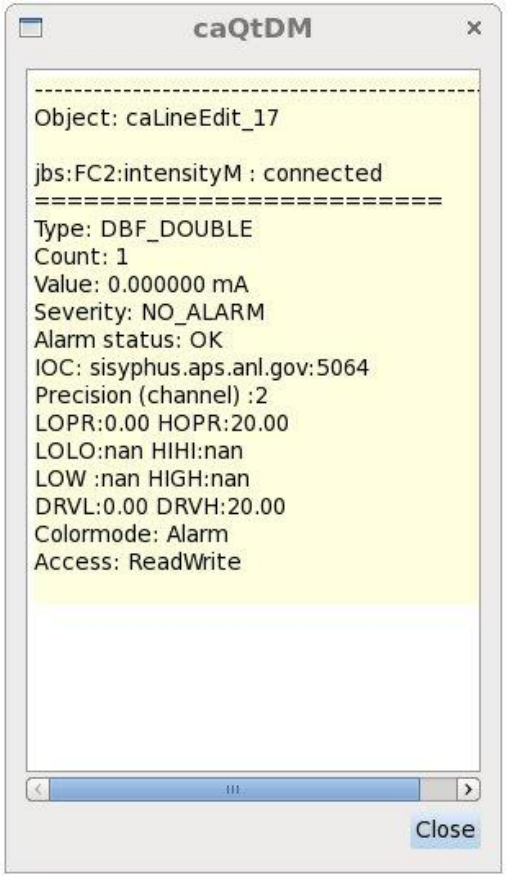
- **caQtDM objects turn white when the connection is lost !**

caQtDM Drag & Drop

- **You can drag the process variable names from an object**
  - Use Mouse Button 2 (the middle button)
- **The Process variable name appears in its alarm color on black**
- **Cannot be dragged to any Motif Drop Site**
  - This includes Probe, StripTool, HistTool, and others
- **Names can be dragged into a Linux text editor**
  - Can paste them in the usual places without even dragging
- **Mouse Button 2 is a fast way to see the process variable name**
- **Doesn't work on a Mac**

caQtDM PV Info

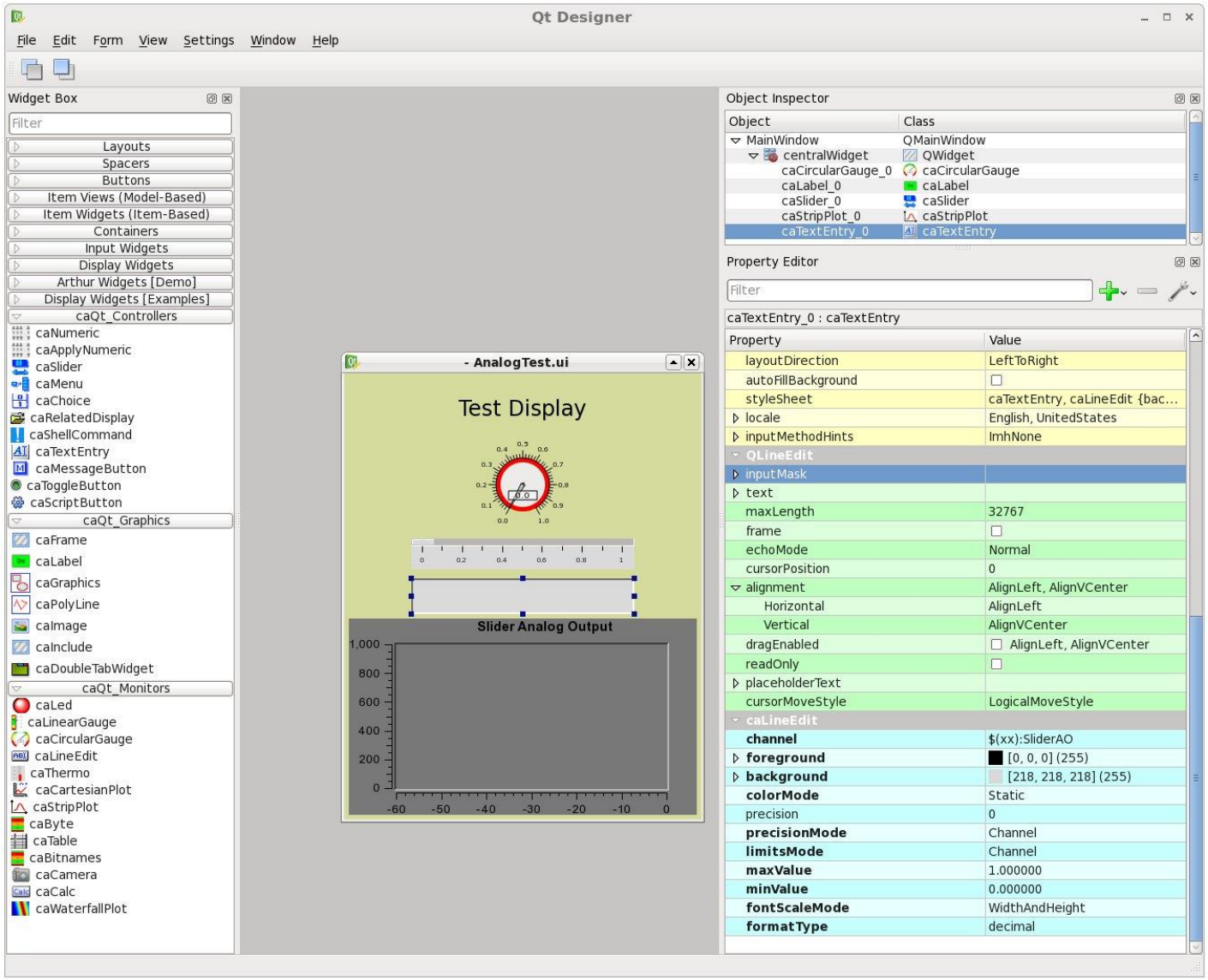
- **PV Info**
  - Gives extensive information about the process variable
- **Hover Mouse Pointer Over Widget**
  - Process Variable Name Appears
  - Right click “Get Info” Icon
  - Left Click



caQtDM PV Limits

- **PV Limits**
  - Allows you to set the limits for Meters, Sliders, etc
- **The user can:**
  - Use the values from Channel Access (HOPR, LOPR, PREC)
  - Use the defaults set by the screen designer
- **The screen designer can:**
  - Set it to use Channel Access values
  - Define the limits
- **Settings Found On Property Editor**

caQtDM PV Limits



caQtDM Macros

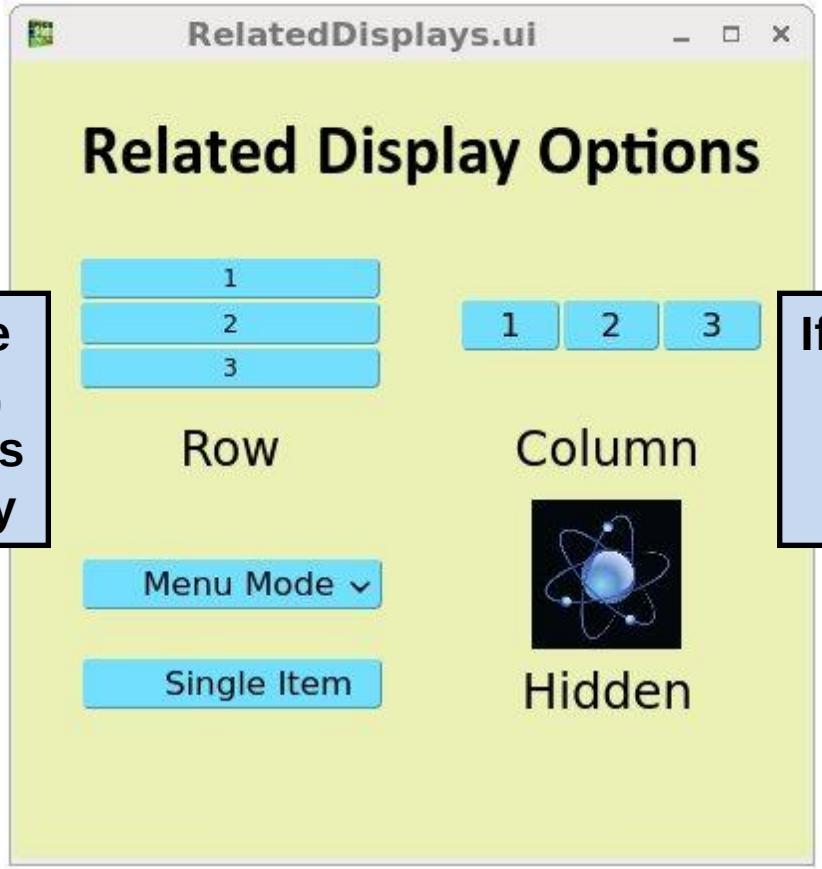
- **Strings of the form $(name) in an ADL file can be replaced by some other string**
  - For example, enter $(sector):$(corrector) as part of a PV name
- **Replacement is specified:**
  - 1. On command line:

    caQtDM –macro ”sector=S1A,corrector=H2”
  - 2. In Related Display configuration:

    Property Editor select **args** xx=$(xx)
- **Allows you to design one screen and use it for many similar items**
- **The Main_XXXX.ui display uses $(xx) in front of PV names**
  - So different users have their own PV names
  - caQtDM –macro “xx=user00” Main_XXXX.ui &

caQtDM Related Display

- Brings up a menu of other displays
- As with most caQtDM widgets there are many options

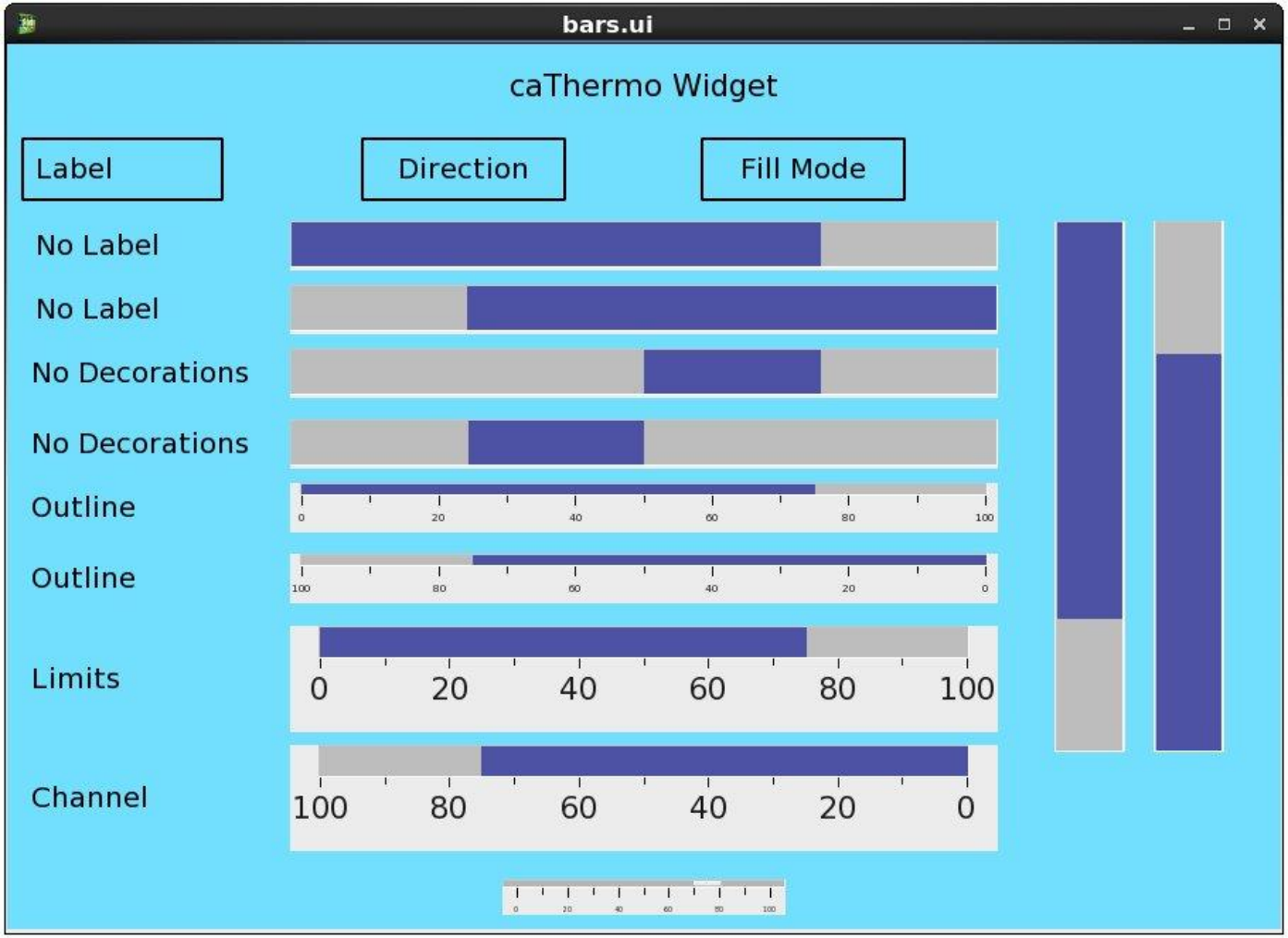


If there is only one item on the menu, clicking on it brings up that one display

If there is more than one item in the menu, a down arrow appears

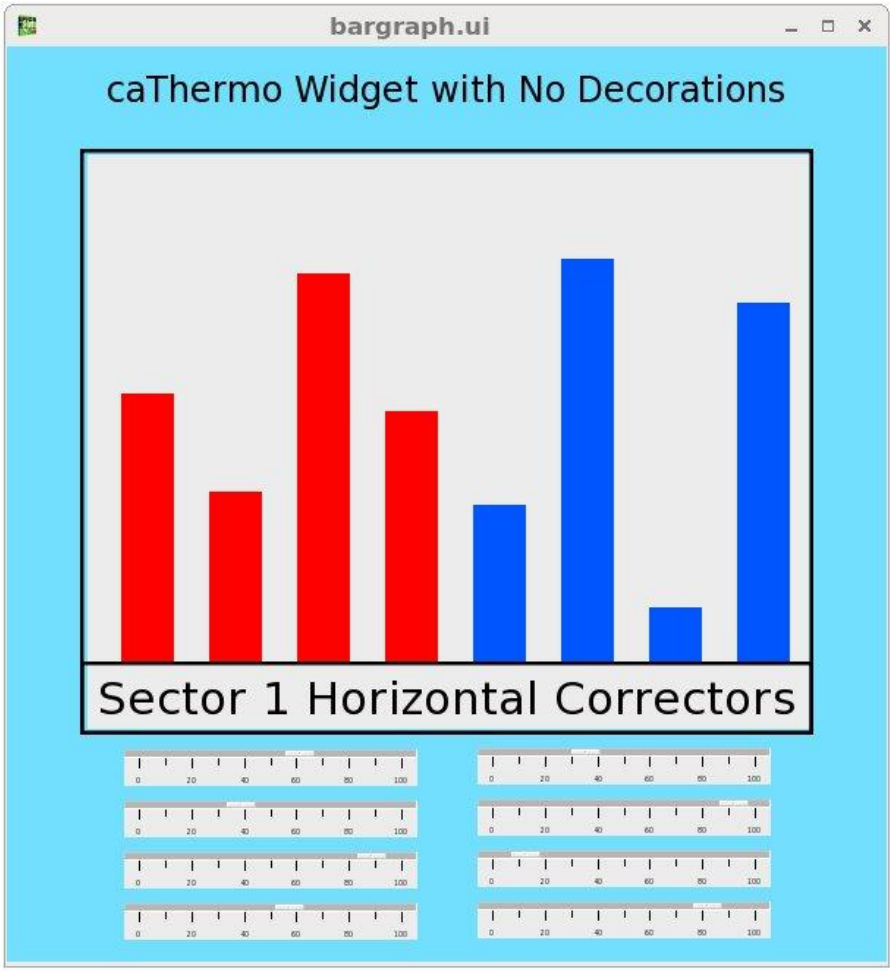
caQtDM caThermo

- Here are some options for the caThermo Widget



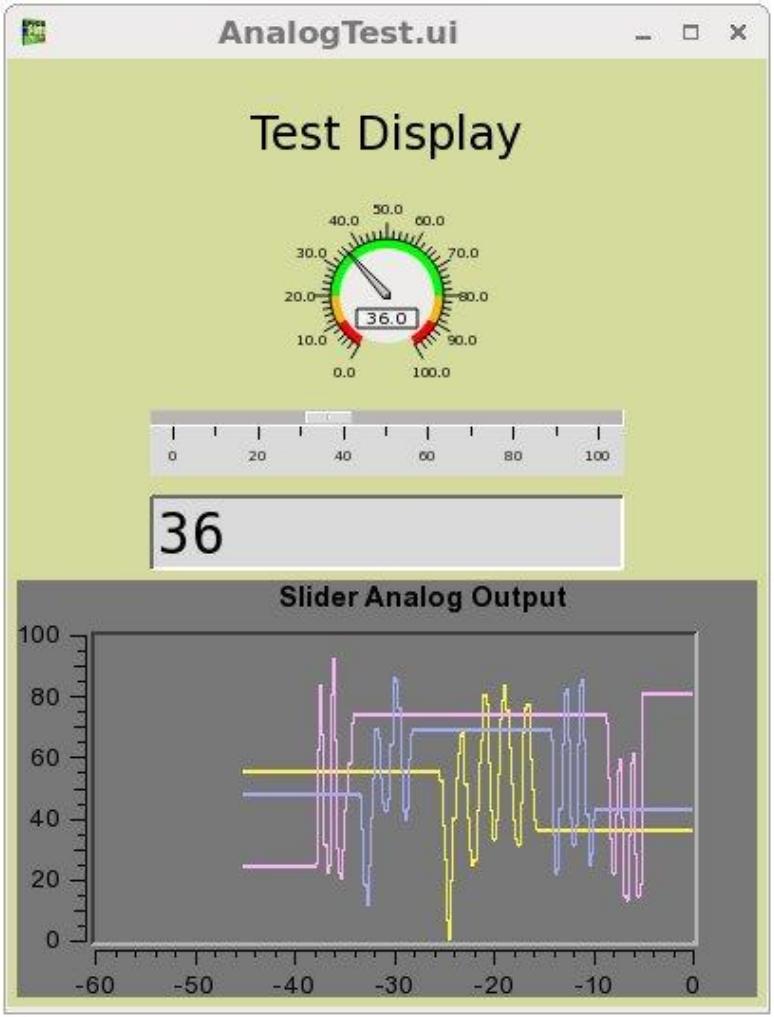
CaQTDM caThermo Widget

- The no decorations mode, useful for bar graphs and effects

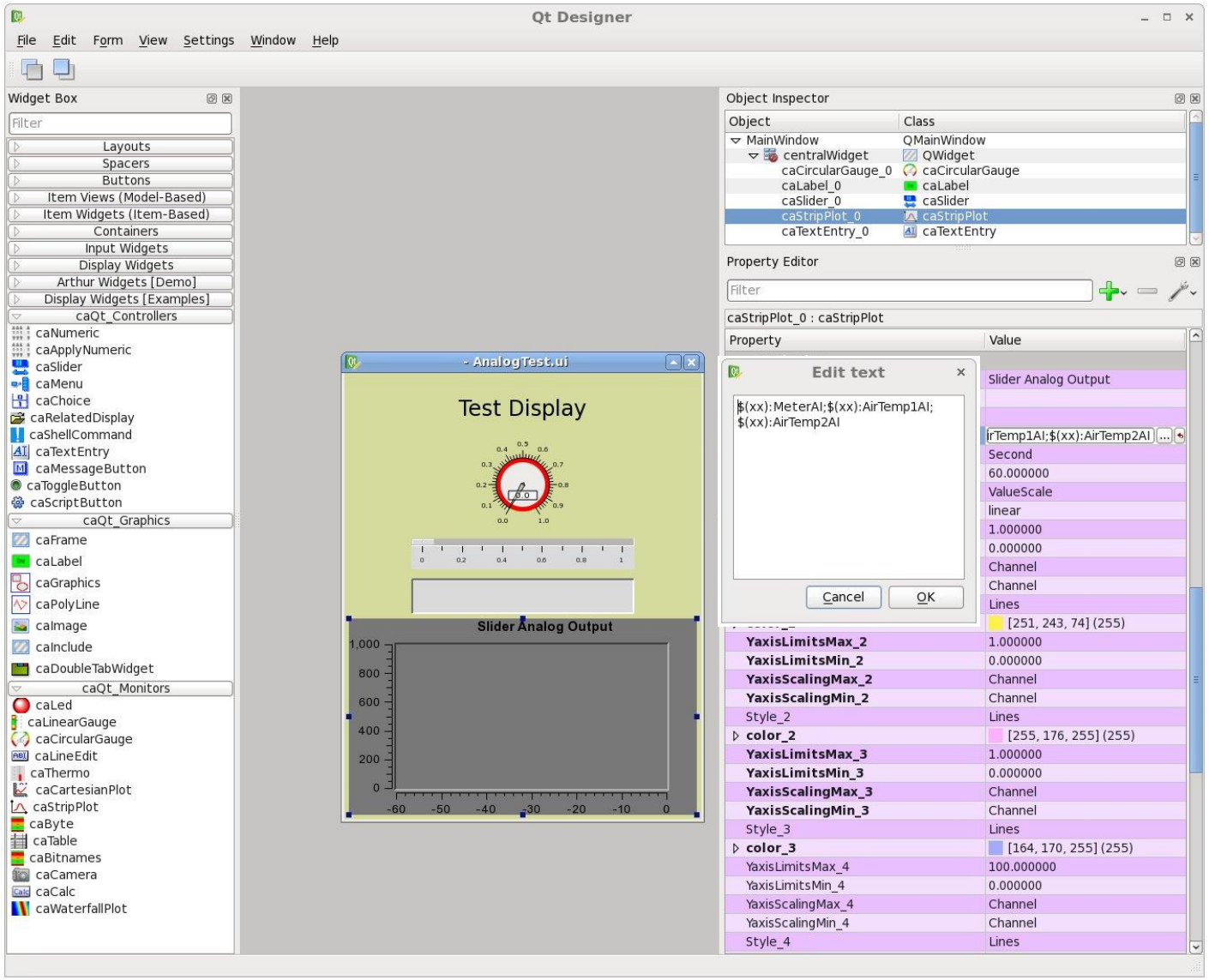


caQtDM Strip Chart

- The caStripPlot Widget Plots Up to Seven Output Values

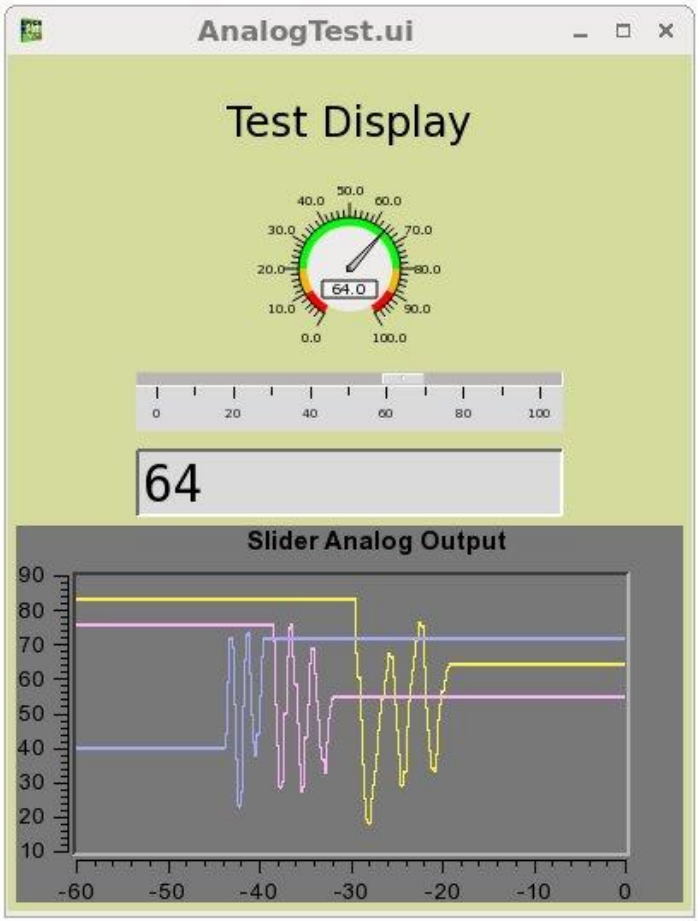


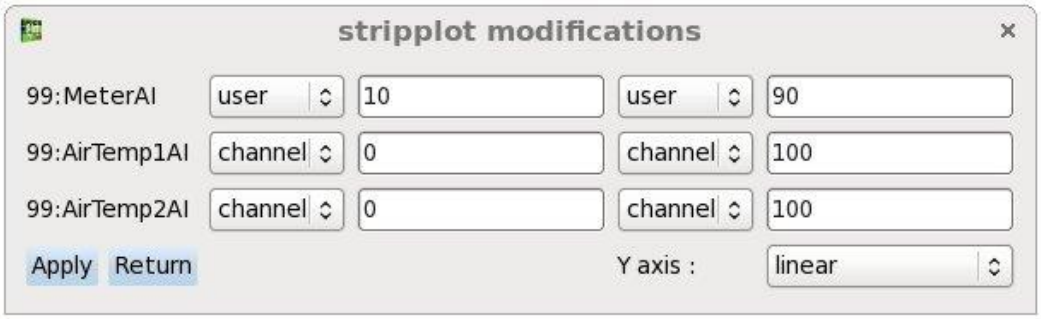
caQtDM Strip Chart



caQtDM Strip Chart

- Right Click On Active Display To Modify Strip Chart





caQtDM Plot Widgets

- Strip Plot (Strip Chart)
- The Cartesian Plot is the most complicated caQtDM widget
  - caQtDM uses the Qwt package
  - Plots Up To 6 Curves
  - Plot Arrays Using Waveform Records
  - Plot Scalar Using A Single Process Variable
- Waterfall Plot
  - Also Plots Waveforms & Scalars

caQtDM Documentation

- There is a caQtDM web page
  - http://epics.web.psi/software/caqtdm
  - http://epics.web.psi/software/caqtdm/caQtDM_Manual
  - http://epics.web.psi.ch/software/caqtdm/TUPPC121.pdf
- Qt Project Homepage
  - http://qt-project.org/

caQtDM Tutorial

‘Hands On’ Demonstration

- How To Create A Display
  - Mode Button, File Edit & Palette Menus
- File Operations
  - New Display, New, Open, Save, Close & Print
- Palettes
  - Object Types (Graphic, Monitors, Controllers)
  - Resource, Color, & Object Palettes
  - Dimensions, Colors, Objects
- Macros & Dynamic Attributes
  - String Substitutions, Calc Expressions

VNC Instructions For A Mac Laptop

1. In Apple Finder, Press Command-K, or in the menu, select “Go Connect to Server…”. This brings up the Connect to Server dialog box.
2. In the Server Address box type "vnc://crackle-vm:5962" and press the Connect button. The Screen Sharing application should start and prompt you "Enter your password to share the screen of crackle-vm:5962".
3. Type "epics!" into the the password box (without the quotes) and press Connect.
4. You should now see the redhat Linux login screen where you can enter the username and password given to you.