# NEW GENERATION QT CONTROL COMPONENTS FOR HIGH LEVEL SOFTWARE

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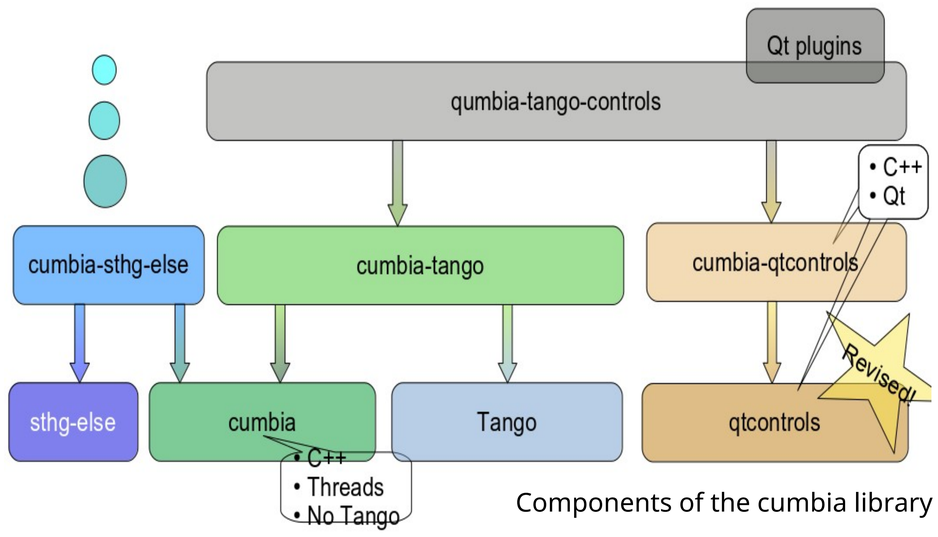
A new generation of Qt graphical components, namely cumbia-qtcontrols-ng is under development at ELETTRA. A common engine allows each component to be rendered on traditional Qt Widgets and scalable Qt GraphicsItems alike. The latter technology makes it possible to integrate live controls with static SVG in order to realize any kind of synoptic with touch and scaling capabilities. A pluggable zoomer can be installed on any widget or graphics item. Apply numeric controls, Cartesian and Circular (Radar) plots are the first components realized.

## MOTIVATION

The ELETTRA synchrotron light source in Trieste, Italy, will be subjected to a major upgrade in the forthcoming years. The rationale is a substantial reduction of the emittance of the stored electron beam, targeting its levels so as to provide a diffraction limited X-ray source also in the horizontal plane. On that account, the new machine, ELETTRA 2.0, will provide intense nano-beams in the range of VUV to X-rays for the analytical study of matter with very high spatial resolution.
ELETTRA 2.0 and the continuous challenges posed by the FERMI@ELETTRA free electron laser encouraged the development of a new generation of Qt graphical components, based on the cumbia libraries and the Qt SVG and Graphics Scene technologies. The acquisition of a 55 inches 4K touch screen for the control room inspired the design of the new graphical objects with touch interaction in mind. They are offered by the new cumbia-qtcontrols-ng library, which flanks the cumbia-svg module.



Components of the cumbia library

## TECHNOLOGY

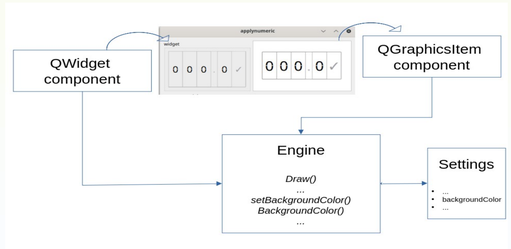
**Qt Graphics View** provides a surface (scene) for managing and interacting with a large number of custom-made 2D graphical items, and a view widget for visualizing the items, with support for zooming and rotation.

**Qt SVG** provides classes for rendering and displaying SVG drawings in widgets and on other paint devices.

The **cumbia** libraries are a multi threaded set of components written in C++ aimed at interfacing the lower level control system servers to the graphical applications for the control room. The separate layers and plugins that make up the framework are designed to integrate with Tango, EPICS and potentially any other distributed control systems and offer an engine independent interface to the clients.

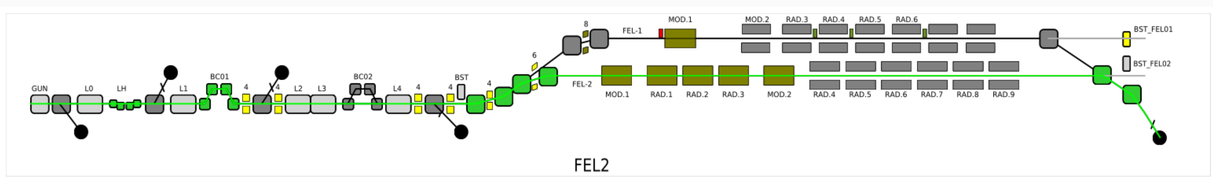
## CUMBIA QTCONTROLS NG

The new generation of cumbia controls focuses on the design of high level software, offering components for custom-tailored data visualization as well as for synoptic applications. The graphical components are designed to be used both in the context of traditional Qt widgets and as items in a Graphics View. A common painter draws on either paint device, presenting the same appearance regardless the technology. Within a Graphics View, the objects shall be scalable and integrated into SVG.



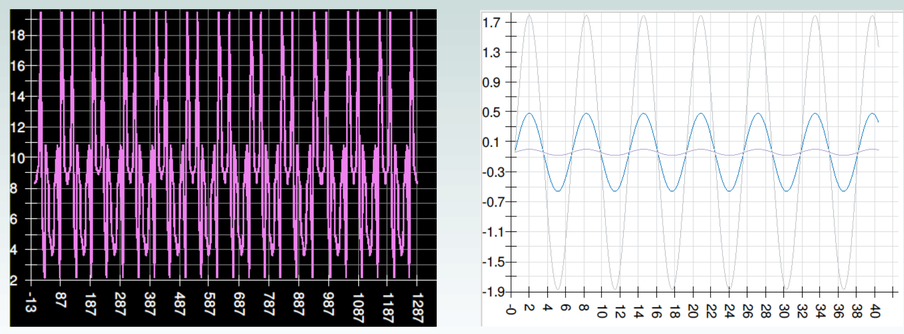

## CUMBIA-SVG

The Qt SVG C++ module provides functionality for handling SVG elements. The cumbia engines and infrastructures can be used to change any SVG element. SVG elements in the drawing can be connected to values obtained from the available *cumbia* engines and their properties changed accordingly. In several cases, the connections defined and the type of attributes in the SVG elements allow for automatic changes in the representation of the object within the drawing. In more complex ones, the programmer will map values from the engines to values of the attributes in the SVG DOM document. The picture below shows a snippet of a synoptic application employing a *cumbia svg* view.

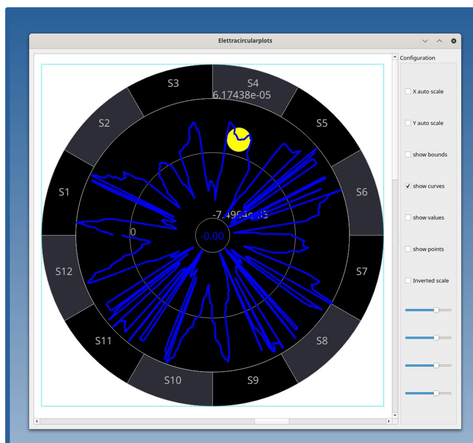



## CARTESIAN PLOT

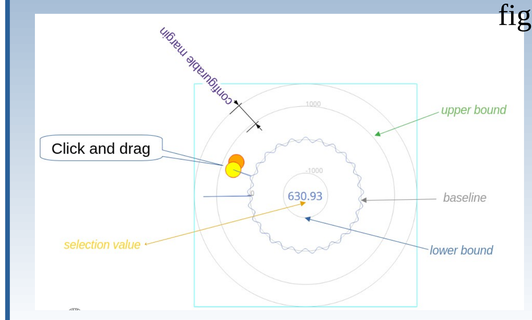
The Graphics Plot Item is a Qt Graphics Item that draws a chart. It is highly customizable, supports multiple curves with either scalar or spectrum data

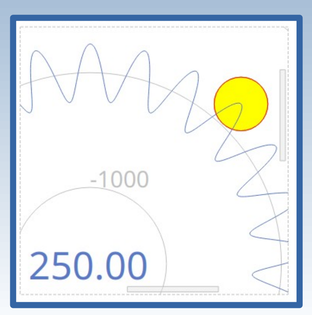


## CIRCULAR (RADAR) PLOT




**U**nder the perspective of ELETTRA 2.0, a component tailored to draw curves along the storage ring has been conceived to replace traditional histogram charts. Spectrum data with umpteen points shall be drawn at extreme refresh rates. The design pursues instinctive engagement of the user in the context of circular machines, notably in the representation of orbit and optics figures.



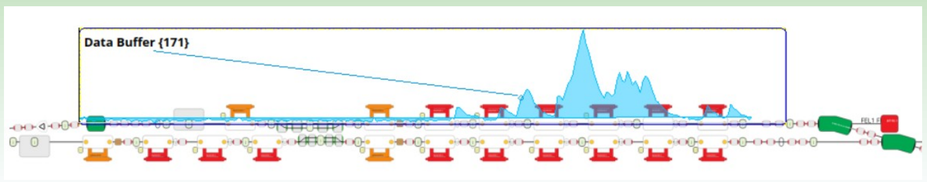




## ZOOMER

Graphics View rotates and scales items in the scene. Nevertheless, the user may need to zoom a given area of an item without affecting the scale of the others. The generic zoomer in the new cumbia qtcontrols will zoom anything, GraphicsItems and traditional Qt Widgets.

## SVG AND CUSTOM GRAPHICS ITEMS COMBINED

Combined SVG and Graphics View technologies yield dynamic, user-friendly and composite applications where static items flank live and fully interactive customly drawn objects. The picture shows yet another synoptic view with a plot drawn on top of an SVG view.

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