PythonQwt Manual

Release 0.16.3

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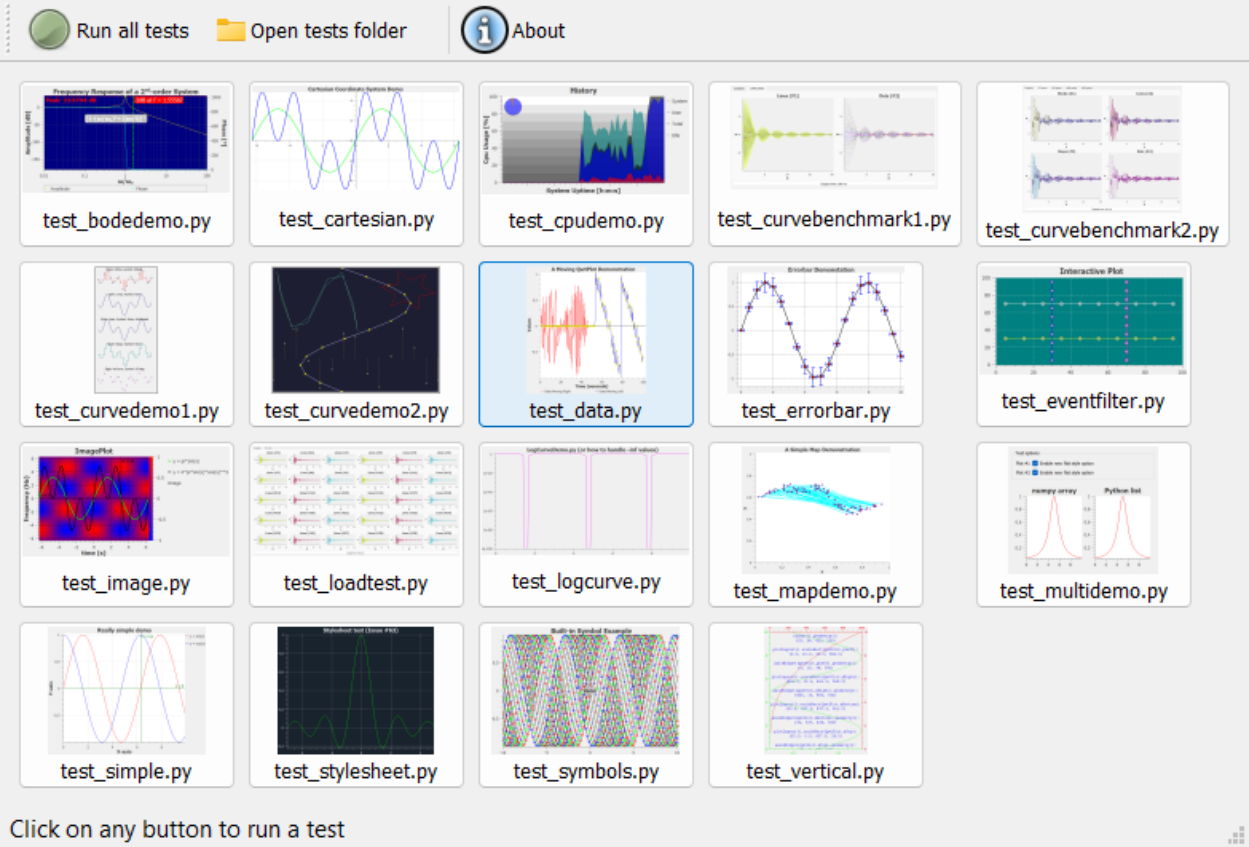
CONTENTS

The `PythonQwt` package is a 2D-data plotting library using Qt graphical user interfaces for the Python programming language.

It consists of a single Python package named *qwt* which is a pure Python implementation of Qwt C++ library with some limitations.



External resources:

- Python Package Index: PyPI
- Project page on GitHub: GitHubPage
- Bug reports and feature requests: GitHub

Contents:

CHAPTER

ONE

PURPOSE AND MOTIVATION

The `PythonQwt` project was initiated to solve -at least temporarily- the obsolescence issue of *PyQwt* (the Python-Qwt C++ bindings library) which is no longer maintained. The idea was to translate the original Qwt C++ code to Python and then to optimize some parts of the code by writing new modules based on NumPy and other libraries.

CHAPTER

TWO

OVERVIEW

The `PythonQwt` package consists of a single Python package named *qwt* and of a few other files (examples, doc, ...):

- The subpackage *qwt.tests* contains the PythonQwt unit tests:
  - 75% were directly adapted from Qwt/C++ demos (Bode demo, cartesian demo, etc.).
  - 25% were written specifically for PythonQwt.
  - The test launcher is an exclusive PythonQwt feature.

The *qwt* package is a pure Python implementation of *Qwt* C++ library with the following limitations.

The following *Qwt* classes won't be reimplemented in *qwt* because more powerful features already exist in *PlotPy*: *QwtPlotZoomer*, *QwtCounter*, *QwtEventPattern*, *QwtPicker*, *QwtPlotPicker*.

Only the following plot items are currently implemented in *qwt* (the only plot items needed by *PlotPy*): *QwtPlotItem* (base class), *QwtPlotGrid*, *QwtPlotMarker*, *QwtPlotSeriesItem* and *QwtPlotCurve*.

The *HistogramItem* object implemented in PyQwt's HistogramDemo.py is not available here (a similar item is already implemented in *PlotPy*). As a consequence, the following classes are not implemented: *QwtPlotHistogram*, *QwtIntervalSeriesData*, *QwtIntervalSample*.

The following data structure objects are not implemented as they seemed irrelevant with Python and NumPy: *QwtCPointerData* (as a consequence, method *QwtPlot.setRawSamples* is not implemented), *QwtSyntheticPointData*.

The following sample data type objects are not implemented as they seemed quite specific: *QwtSetSample*, *QwtOHLCSample*. For similar reasons, the *QwtPointPolar* class and the following sample iterator objects are not implemented: *QwtSetSeriesData*, *QwtTradingChartData* and *QwtPoint3DSeriesData*.

The following classes are not implemented because they seem inappropriate in the Python/NumPy context: *QwtArraySeriesData*, *QwtPointSeriesData*, *QwtAbstractSeriesStore*.

Threads:

- Multiple threads for graphic rendering is implemented in Qwt C++ code thanks to the *QtConcurrent* and *QFuture* Qt features which are currently not supported by PyQt.
- **As a consequence the following API is not supported in *PythonQwt*:**
  - *QwtPlotItem.renderThreadCount*
  - *QwtPlotItem.setRenderThreadCount*
  - option *numThreads* in *QwtPointMapper.toImage*

The *QwtClipper* class is not implemented yet (and it will probably be very difficult or even impossible to implement it in pure Python without performance issues). As a consequence, when zooming in a plot curve, the entire curve is still painted (in other words, when working with large amount of data, there is no performance gain when zooming in).

The curve fitter feature is not implemented because powerful curve fitting features are already implemented in *PlotPy*.

Other API compatibility issues with *Qwt*:

- *QwtPlotCurve.MinimizeMemory* option was removed as this option has no sense in PythonQwt (the polyline plotting is not taking more memory than the array data that is already there).
- *QwtPlotCurve.Fitted* option was removed as this option is not supported at the moment.

CHAPTER

THREE

INSTALLATION

3.1 Dependencies

Requirements:

- Python 3.9 or higher
- PyQt5 5.15, PyQt6 or PySide6
- QtPy 1.9 or higher
- NumPy 1.21 or higher
- Sphinx for documentation generation
- pytest, coverage for unit testing

3.2 Installation

From PyPI:

pip install PythonQwt

From the source package:

python -m build

3.3 Help and support

External resources:

- Bug reports and feature requests: GitHub

CHAPTER

FOUR

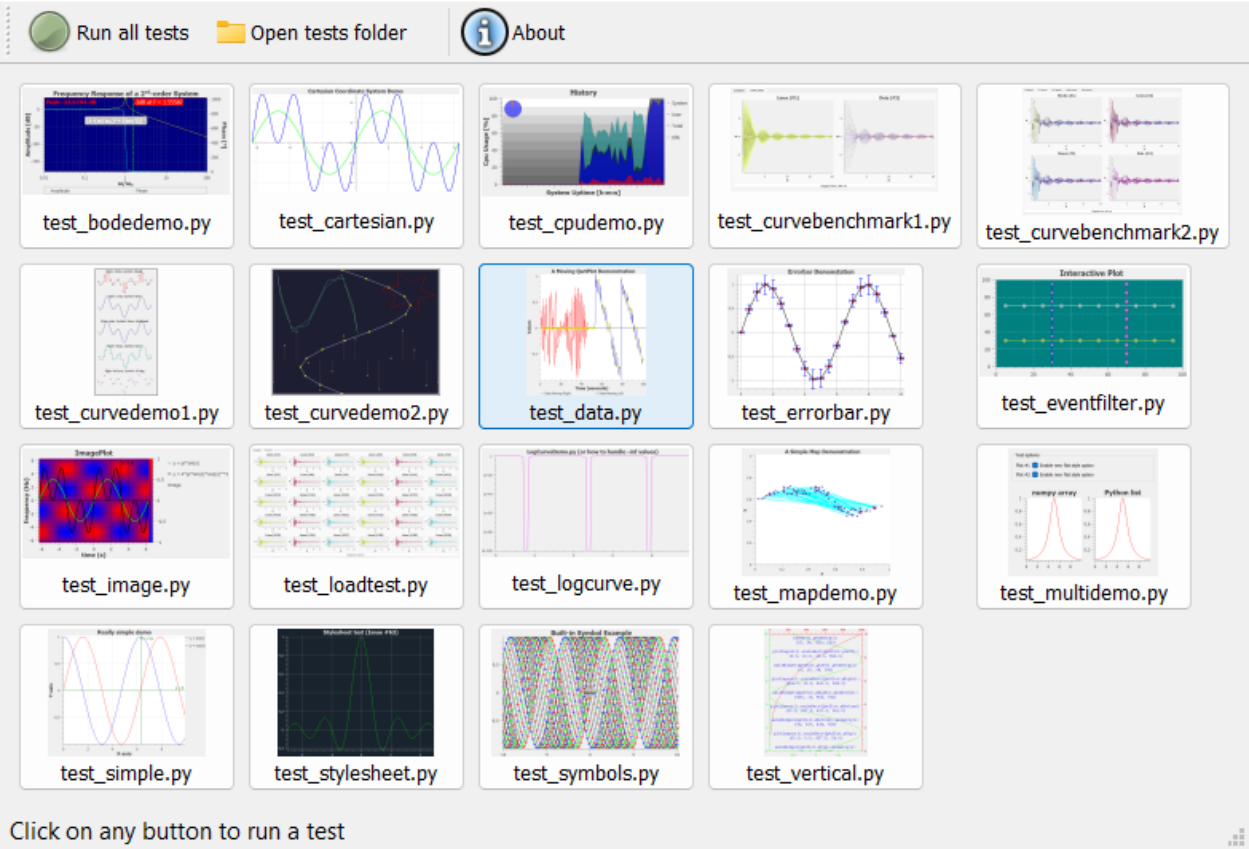
EXAMPLES

4.1 The test launcher

A lot of examples are available in the `qwt.tests` module

```
from qwt import tests
tests.run()
```

The two lines above execute the `PythonQwt-tests` test launcher:



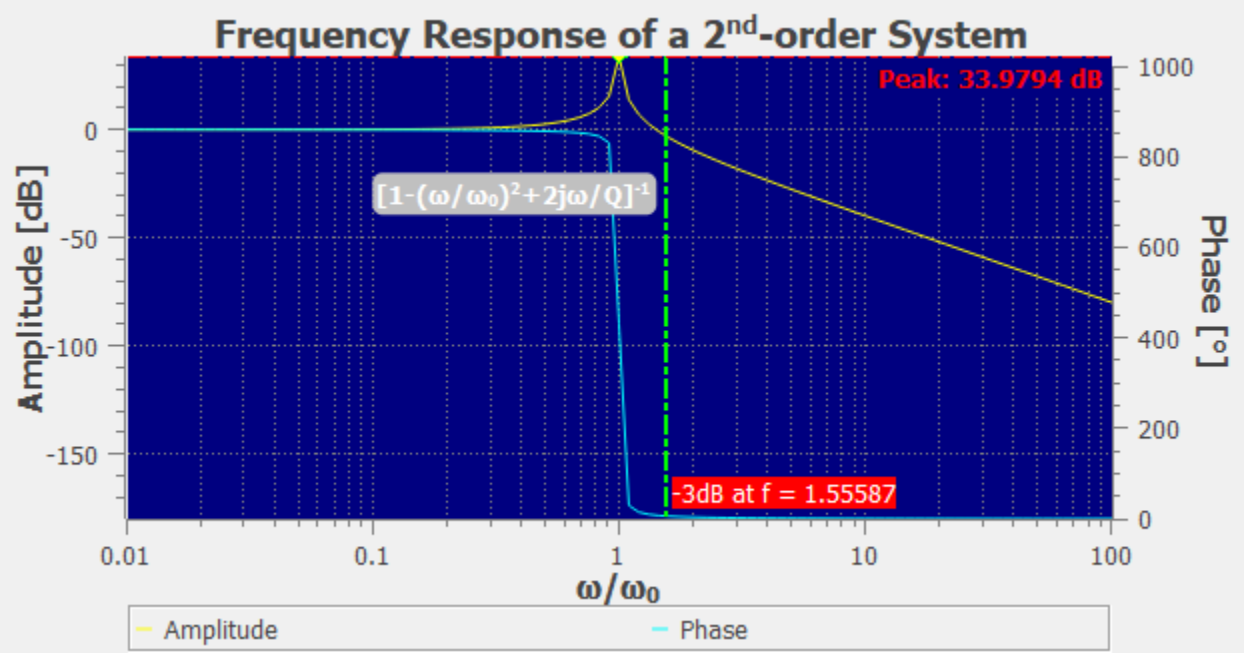
GUI-based test launcher can be executed from the command line thanks to the `PythonQwt-tests` test script.

Unit tests may be executed from the command line thanks to the console-based script `PythonQwt-tests`: `PythonQwt-tests --mode unattended`.

4.2 Tests

Here are some examples from the *qwt.tests* module:

4.2.1 Bode demo




```
import os

import numpy as np
from qtpy.QtCore import Qt
from qtpy.QtGui import QFont, QIcon, QPageLayout, QPen, QPixmap
from qtpy.QtPrintSupport import QPrintDialog, QPrinter
from qtpy.QtWidgets import (
    QFrame,
    QHBoxLayout,
    QLabel,
    QMainWindow,
    QToolBar,
    QToolButton,
    QWidget,
)

from qwt import (
    QwtLegend,
    QwtLogScaleEngine,
    QwtPlot,
    QwtPlotCurve,
    QwtPlotGrid,
    QwtPlotMarker,
    QwtPlotRenderer,
    QwtSymbol,
```

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```
    QwtText,
)
from qwt.tests import utils

print_xpm = [
    "32 32 12 1",
    "a c #ffffff",
    "h c #ffff00",
    "c c #ffffff",
    "f c #dcdcdc",
    "b c #c0c0c0",
    "j c #a0a0a4",
    "e c #808080",
    "g c #808000",
    "d c #585858",
    "i c #00ff00",
    "# c #000000",
    ". c None",
    "................................",
    "................................",
    "............###.................",
    "...........#abb###..............",
    ".........#aabbbbb###............",
    ".........#ddaaabbbbb###.........",
    ".........#ddddddaaabbbbb###.....",
    ".......#deffddddddaaabbbbb###...",
    "......#deaaabbbddddddaaabbbbb###",
    ".....#deaaaaaaabbbddddddaaabbbb#",
    "....#deaaabbbaaaa#ddedddfggaaad#",
    "...#deaaaaaaaaa#ddeeeeafgggfdd#",
    "..#deaaabbbaaaa#ddeeeeabbbbgfdd#",
    ".#deeefaaaaaaa#ddeeeeabbhhbbadd#",
    "#aabbbeeefaaa#ddeeeeabbbbbbaddd#",
    "#bbaaabbbeee#ddeeeeabbiibbadddd#",
    "#bbbbbaaabbbeeeeeeabbbbbbadddddd#",
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    ".........###bbbbbbbbbdd#........",
    "............###bbbbbbd#.........",
    "..............###bbb#...........",
    "................###.............",
]
```

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```
class BodePlot(QwtPlot):
    def __init__(self, *args):
        QwtPlot.__init__(self, *args)

        self.setTitle("Frequency Response of a 2<sup>nd</sup>-order System")
        self.setCanvasBackground(Qt.darkBlue)

        # legend
        legend = QwtLegend()
        legend.setFrameStyle(QFrame.Box | QFrame.Sunken)
        self.insertLegend(legend, QwtPlot.BottomLegend)

        # grid
        QwtPlotGrid.make(plot=self, enableminor=(True, False), color=Qt.darkGray)

        # axes
        self.enableAxis(QwtPlot.yRight)
        self.setAxisTitle(QwtPlot.xBottom, "\u03c9/\u03c9<sub>0</sub>")
        self.setAxisTitle(QwtPlot.yLeft, "Amplitude [dB]")
        self.setAxisTitle(QwtPlot.yRight, "Phase [\u00b0]")

        self.setAxisMaxMajor(QwtPlot.xBottom, 6)
        self.setAxisMaxMinor(QwtPlot.xBottom, 10)
        self.setAxisScaleEngine(QwtPlot.xBottom, QwtLogScaleEngine())

        # curves
        self.curve1 = QwtPlotCurve.make(
            title="Amplitude", linecolor=Qt.yellow, plot=self, antialiased=True
        )
        self.curve2 = QwtPlotCurve.make(
            title="Phase", linecolor=Qt.cyan, plot=self, antialiased=True
        )
        self.dB3Marker = QwtPlotMarker.make(
            label=QwtText.make(color=Qt.white, brush=Qt.red, weight=QFont.Light),
            linestyle=QwtPlotMarker.VLine,
            align=Qt.AlignRight | Qt.AlignBottom,
            color=Qt.green,
            width=2,
            style=Qt.DashDotLine,
            plot=self,
        )
        self.peakMarker = QwtPlotMarker.make(
            label=QwtText.make(
                color=Qt.red, brush=self.canvasBackground(), weight=QFont.Bold
            ),
            symbol=QwtSymbol.make(QwtSymbol.Diamond, Qt.yellow, Qt.green, (7, 7)),
            linestyle=QwtPlotMarker.HLine,
            align=Qt.AlignRight | Qt.AlignBottom,
            color=Qt.red,
            width=2,
            style=Qt.DashDotLine,
```

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```
            plot=self,
        )
        QwtPlotMarker.make(
            xvalue=0.1,
            yvalue=-20.0,
            align=Qt.AlignRight | Qt.AlignBottom,
            label=QwtText.make(
                "[1-(\u03c9/\u03c9<sub>0</sub>)<sup>2</sup>+2j\u03c9/Q]<sup>-1</sup>",
                color=Qt.white,
                borderradius=2,
                borderpen=QPen(Qt.lightGray, 5),
                brush=Qt.lightGray,
                weight=QFont.Bold,
            ),
            plot=self,
        )

        self.setDamp(0.01)

    def showData(self, frequency, amplitude, phase):
        self.curve1.setData(frequency, amplitude)
        self.curve2.setData(frequency, phase)

    def showPeak(self, frequency, amplitude):
        self.peakMarker.setValue(frequency, amplitude)
        label = self.peakMarker.label()
        label.setText("Peak: %4g dB" % amplitude)
        self.peakMarker.setLabel(label)

    def show3dB(self, frequency):
        self.dB3Marker.setValue(frequency, 0.0)
        label = self.dB3Marker.label()
        label.setText("-3dB at f = %4g" % frequency)
        self.dB3Marker.setLabel(label)

    def setDamp(self, d):
        self.damping = d
        # Numerical Python: f, g, a and p are NumPy arrays!
        f = np.exp(np.log(10.0) * np.arange(-2, 2.02, 0.04))
        g = 1.0 / (1.0 - f * f + 2j * self.damping * f)
        a = 20.0 * np.log10(abs(g))
        p = 180 * np.arctan2(g.imag, g.real) / np.pi
        # for show3dB
        i3 = np.argmax(np.where(np.less(a, -3.0), a, -100.0))
        f3 = f[i3] - (a[i3] + 3.0) * (f[i3] - f[i3 - 1]) / (a[i3] - a[i3 - 1])
        # for showPeak
        imax = np.argmax(a)

        self.showPeak(f[imax], a[imax])
        self.show3dB(f3)
        self.showData(f, a, p)
```

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```
        self.replot()


FNAME_PDF = "bode.pdf"


class BodeDemo(QMainWindow):
    def __init__(self, *args):
        QMainWindow.__init__(self, *args)

        self.plot = BodePlot(self)
        self.plot.setContentsMargins(5, 5, 5, 0)

        self.setContextMenuPolicy(Qt.NoContextMenu)

        self.setCentralWidget(self.plot)

        toolBar = QToolBar(self)
        self.addToolBar(toolBar)

        btnPrint = QToolButton(toolBar)
        btnPrint.setText("Print")
        btnPrint.setIcon(QIcon(QPixmap(print_xpm)))
        btnPrint.setToolButtonStyle(Qt.ToolButtonTextUnderIcon)
        toolBar.addWidget(btnPrint)
        btnPrint.clicked.connect(self.print_)

        btnExport = QToolButton(toolBar)
        btnExport.setText("Export")
        btnExport.setIcon(QIcon(QPixmap(print_xpm)))
        btnExport.setToolButtonStyle(Qt.ToolButtonTextUnderIcon)
        toolBar.addWidget(btnExport)
        btnExport.clicked.connect(self.exportDocument)

        toolBar.addSeparator()

        dampBox = QWidget(toolBar)
        dampLayout = QHBoxLayout(dampBox)
        dampLayout.setSpacing(0)
        dampLayout.addWidget(QWidget(dampBox), 10)  # spacer
        dampLayout.addWidget(QLabel("Damping Factor", dampBox), 0)
        dampLayout.addSpacing(10)

        toolBar.addWidget(dampBox)

        self.statusBar()

        self.showInfo()

        if utils.TestEnvironment().unattended:
            self.print_(unattended=True)
```

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```
    def print_(self, unattended=False):
        try:
            mode = QPrinter.HighResolution
            printer = QPrinter(mode)
        except AttributeError:
            # Some PySide6 / PyQt6 versions do not have this attribute on Linux
            printer = QPrinter()

        printer.setCreator("Bode example")
        printer.setPageOrientation(QPageLayout.Landscape)
        try:
            printer.setColorMode(QPrinter.Color)
        except AttributeError:
            pass

        docName = str(self.plot.title().text())
        if not docName:
            docName.replace("\n", " -- ")
            printer.setDocName(docName)

        dialog = QPrintDialog(printer)
        if unattended:
            # Configure QPrinter object to print to PDF file
            printer.setPrinterName("")
            printer.setOutputFileName(FNAME_PDF)
            dialog.accept()
            ok = True
        else:
            ok = dialog.exec_()
        if ok:
            renderer = QwtPlotRenderer()
            renderer.renderTo(self.plot, printer)

    def exportDocument(self):
        renderer = QwtPlotRenderer(self.plot)
        renderer.exportTo(self.plot, "bode")

    def showInfo(self, text=""):
        self.statusBar().showMessage(text)

    def moved(self, point):
        info = "Freq=%g, Ampl=%g, Phase=%g" % (
            self.plot.invTransform(QwtPlot.xBottom, point.x()),
            self.plot.invTransform(QwtPlot.yLeft, point.y()),
            self.plot.invTransform(QwtPlot.yRight, point.y()),
        )
        self.showInfo(info)

    def selected(self, _):
        self.showInfo()
```

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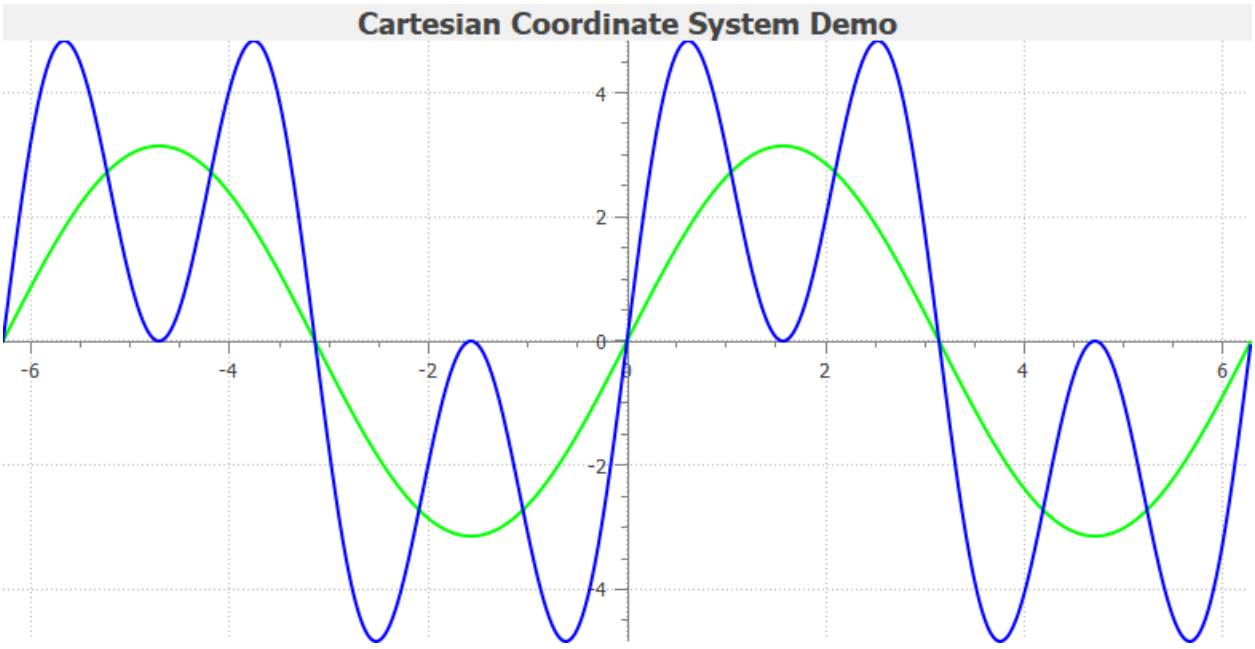
```
def test_bodedemo():
    """Bode demo"""
    utils.test_widget(BodeDemo, (640, 480))
    if os.path.isfile(FNAME_PDF):
        os.remove(FNAME_PDF)


if __name__ == "__main__":
    test_bodedemo()
```

4.2.2 Cartesian demo




```
import numpy as np
from qtpy.QtCore import Qt

from qwt import QwtPlot, QwtPlotCurve, QwtPlotGrid, QwtPlotItem, QwtScaleDraw
from qwt.tests import utils


class CartesianAxis(QwtPlotItem):
    """Supports a coordinate system similar to
    http://en.wikipedia.org/wiki/Image:Cartesian-coordinate-system.svg"""

    def __init__(self, masterAxis, slaveAxis):
        """Valid input values for masterAxis and slaveAxis are QwtPlot.yLeft,
        QwtPlot.yRight, QwtPlot.xBottom, and QwtPlot.xTop. When masterAxis is
        an x-axis, slaveAxis must be an y-axis; and vice versa."""
        QwtPlotItem.__init__(self)
        self.__axis = masterAxis
```

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```
        if masterAxis in (QwtPlot.yLeft, QwtPlot.yRight):
            self.setAxes(slaveAxis, masterAxis)
        else:
            self.setAxes(masterAxis, slaveAxis)
        self.scaleDraw = QwtScaleDraw()
        self.scaleDraw.setAlignment(
            (
                QwtScaleDraw.LeftScale,
                QwtScaleDraw.RightScale,
                QwtScaleDraw.BottomScale,
                QwtScaleDraw.TopScale,
            )[masterAxis]
        )

    def draw(self, painter, xMap, yMap, rect):
        """Draw an axis on the plot canvas"""
        xtr = xMap.transform
        ytr = yMap.transform
        if self.__axis in (QwtPlot.yLeft, QwtPlot.yRight):
            self.scaleDraw.move(round(xtr(0.0)), yMap.p2())
            self.scaleDraw.setLength(yMap.p1() - yMap.p2())
        elif self.__axis in (QwtPlot.xBottom, QwtPlot.xTop):
            self.scaleDraw.move(xMap.p1(), round(ytr(0.0)))
            self.scaleDraw.setLength(xMap.p2() - xMap.p1())
        self.scaleDraw.setScaleDiv(self.plot().axisScaleDiv(self.__axis))
        self.scaleDraw.draw(painter, self.plot().palette())


class CartesianPlot(QwtPlot):
    """Creates a coordinate system similar system
    http://en.wikipedia.org/wiki/Image:Cartesian-coordinate-system.svg"""

    def __init__(self, *args):
        QwtPlot.__init__(self, *args)
        self.setTitle("Cartesian Coordinate System Demo")
        # create a plot with a white canvas
        self.setCanvasBackground(Qt.white)
        # set plot layout
        self.plotLayout().setCanvasMargin(0)
        self.plotLayout().setAlignCanvasToScales(True)
        # attach a grid
        QwtPlotGrid.make(self, color=Qt.lightGray, width=0, style=Qt.DotLine, z=-1)
        # attach a x-axis
        xaxis = CartesianAxis(QwtPlot.xBottom, QwtPlot.yLeft)
        xaxis.attach(self)
        self.enableAxis(QwtPlot.xBottom, False)
        # attach a y-axis
        yaxis = CartesianAxis(QwtPlot.yLeft, QwtPlot.xBottom)
        yaxis.attach(self)
        self.enableAxis(QwtPlot.yLeft, False)
        # calculate 3 NumPy arrays
        x = np.arange(-2 * np.pi, 2 * np.pi, 0.01)
```

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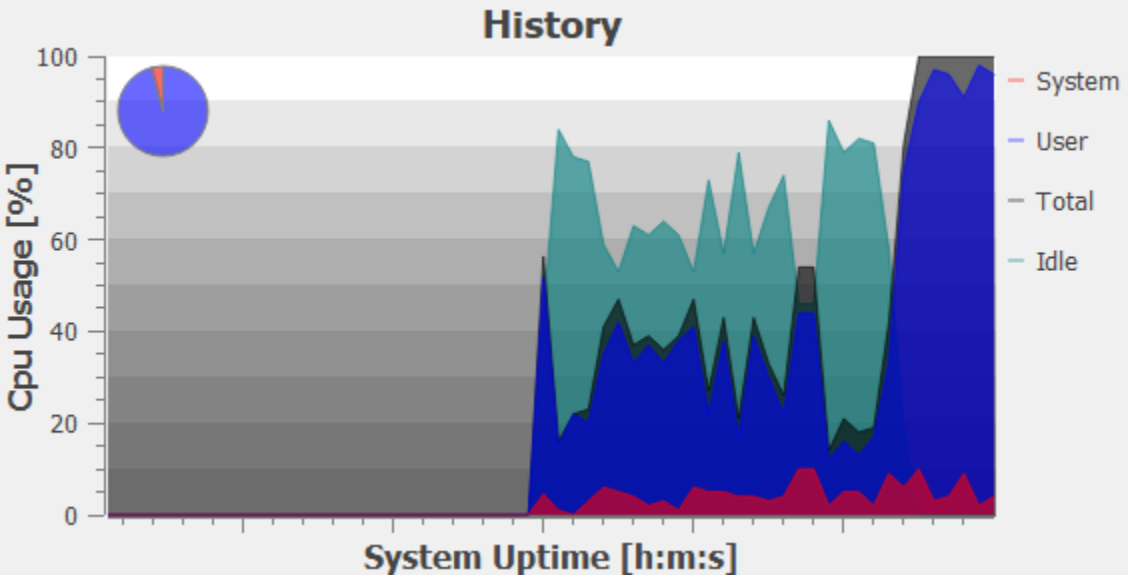
```
        # attach a curve
        QwtPlotCurve.make(
            x,
            np.pi * np.sin(x),
            title="y = pi*sin(x)",
            linecolor=Qt.green,
            linewidth=2,
            plot=self,
            antialiased=True,
        )
        # attach another curve
        QwtPlotCurve.make(
            x,
            4 * np.pi * np.cos(x) * np.cos(x) * np.sin(x),
            title="y = 4*pi*sin(x)*cos(x)**2",
            linecolor=Qt.blue,
            linewidth=2,
            plot=self,
            antialiased=True,
        )
        self.replot()


def test_cartesian():
    """Cartesian plot test"""
    utils.test_widget(CartesianPlot, (800, 480))


if __name__ == "__main__":
    test_cartesian()
```

4.2.3 CPU plot demo



```
import os

import numpy as np
from qtpy.QtCore import QRectF, Qt, QTime
from qtpy.QtGui import QBrush, QColor
from qtpy.QtWidgets import QLabel, QVBoxLayout, QWidget

from qwt import (
    QwtLegend,
    QwtLegendData,
    QwtPlot,
    QwtPlotCurve,
    QwtPlotItem,
    QwtPlotMarker,
    QwtScaleDraw,
    QwtText,
)
from qwt.tests import utils


class CpuStat:
    User = 0
    Nice = 1
    System = 2
    Idle = 3
    counter = 0
    dummyValues = (
        (103726, 0, 23484, 819556),
        (103783, 0, 23489, 819604),
        (103798, 0, 23490, 819688),
        (103820, 0, 23490, 819766),
        (103840, 0, 23493, 819843),
        (103875, 0, 23499, 819902),
        (103917, 0, 23504, 819955),
        (103950, 0, 23508, 820018),
        (103987, 0, 23510, 820079),
        (104020, 0, 23513, 820143),
        (104058, 0, 23514, 820204),
        (104099, 0, 23520, 820257),
        (104121, 0, 23525, 820330),
        (104159, 0, 23530, 820387),
        (104176, 0, 23534, 820466),
        (104215, 0, 23538, 820523),
        (104245, 0, 23541, 820590),
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        (104396, 0, 23577, 821003),
        (104413, 0, 23579, 821084),
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```

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```
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        (106831, 0, 23758, 822087),
        (106862, 0, 23761, 822153),
        (106899, 0, 23763, 822214),
        (106932, 0, 23766, 822278),
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        (107040, 0, 23775, 822461),
        (107092, 0, 23780, 822504),
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        (107200, 0, 23795, 822581),
        (107250, 0, 23803, 822623),
        (107277, 0, 23810, 822689),
        (107286, 0, 23810, 822780),
        (107313, 0, 23817, 822846),
        (107325, 0, 23818, 822933),
        (107332, 0, 23818, 823026),
        (107344, 0, 23821, 823111),
        (107357, 0, 23821, 823198),
```

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```
        (107368, 0, 23823, 823284),
        (107375, 0, 23824, 823377),
        (107386, 0, 23825, 823465),
        (107396, 0, 23826, 823554),
        (107422, 0, 23830, 823624),
        (107434, 0, 23831, 823711),
        (107456, 0, 23835, 823785),
        (107468, 0, 23838, 823870),
        (107487, 0, 23840, 823949),
        (107515, 0, 23843, 824018),
        (107528, 0, 23846, 824102),
        (107535, 0, 23851, 824190),
        (107548, 0, 23853, 824275),
        (107562, 0, 23857, 824357),
        (107656, 0, 23863, 824357),
        (107751, 0, 23868, 824357),
        (107849, 0, 23870, 824357),
        (107944, 0, 23875, 824357),
        (108043, 0, 23876, 824357),
        (108137, 0, 23882, 824357),
        (108230, 0, 23889, 824357),
        (108317, 0, 23902, 824357),
        (108412, 0, 23907, 824357),
        (108511, 0, 23908, 824357),
        (108608, 0, 23911, 824357),
        (108704, 0, 23915, 824357),
        (108801, 0, 23918, 824357),
        (108891, 0, 23928, 824357),
        (108987, 0, 23932, 824357),
        (109072, 0, 23943, 824361),
        (109079, 0, 23943, 824454),
        (109086, 0, 23944, 824546),
        (109098, 0, 23950, 824628),
        (109108, 0, 23955, 824713),
        (109115, 0, 23957, 824804),
        (109122, 0, 23958, 824896),
        (109132, 0, 23959, 824985),
        (109142, 0, 23961, 825073),
        (109146, 0, 23962, 825168),
        (109153, 0, 23964, 825259),
        (109162, 0, 23966, 825348),
        (109168, 0, 23969, 825439),
        (109176, 0, 23971, 825529),
        (109185, 0, 23974, 825617),
        (109193, 0, 23977, 825706),
        (109198, 0, 23978, 825800),
        (109206, 0, 23978, 825892),
        (109212, 0, 23981, 825983),
        (109219, 0, 23981, 826076),
        (109225, 0, 23981, 826170),
        (109232, 0, 23984, 826260),
        (109242, 0, 23984, 826350),
```

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```
        (109255, 0, 23986, 826435),
        (109268, 0, 23987, 826521),
        (109283, 0, 23990, 826603),
        (109288, 0, 23991, 826697),
        (109295, 0, 23993, 826788),
        (109308, 0, 23994, 826874),
        (109322, 0, 24009, 826945),
        (109328, 0, 24011, 827037),
        (109338, 0, 24012, 827126),
        (109347, 0, 24012, 827217),
        (109354, 0, 24017, 827305),
        (109367, 0, 24017, 827392),
        (109371, 0, 24019, 827486),
    )

    def __init__(self):
        self.procValues = self.__lookup()

    def statistic(self):
        values = self.__lookup()
        userDelta = 0.0
        for i in [CpuStat.User, CpuStat.Nice]:
            userDelta += values[i] - self.procValues[i]
        systemDelta = values[CpuStat.System] - self.procValues[CpuStat.System]
        totalDelta = 0.0
        for i in range(len(self.procValues)):
            totalDelta += values[i] - self.procValues[i]
        self.procValues = values
        return 100.0 * userDelta / totalDelta, 100.0 * systemDelta / totalDelta

    def upTime(self):
        result = QTime(0, 0, 0)
        for item in self.procValues:
            result = result.addSecs(int(0.01 * item))
        return result

    def __lookup(self):
        if os.path.exists("/proc/stat"):
            with open("/proc/stat") as file:
                for line in file:
                    words = line.split()
                    if words[0] == "cpu" and len(words) >= 5:
                        return [float(w) for w in words[1:]]
        else:
            result = CpuStat.dummyValues[CpuStat.counter]
            CpuStat.counter += 1
            CpuStat.counter %= len(CpuStat.dummyValues)
            return result


class CpuPieMarker(QwtPlotMarker):
    def __init__(self, *args):
```

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```
        QwtPlotMarker.__init__(self, *args)
        self.setZ(1000.0)
        self.setRenderHint(QwtPlotItem.RenderAntialiased, True)

    def rtti(self):
        return QwtPlotItem.Rtti_PlotUserItem

    def draw(self, painter, xMap, yMap, rect):
        margin = 5
        pieRect = QRectF()
        pieRect.setX(rect.x() + margin)
        pieRect.setY(rect.y() + margin)
        pieRect.setHeight(int(yMap.transform(80.0)))
        pieRect.setWidth(pieRect.height())

        angle = 3 * 5760 / 4
        for key in ["User", "System", "Idle"]:
            curve = self.plot().cpuPlotCurve(key)
            if curve.dataSize():
                value = int(5760 * curve.sample(0).y() / 100.0)
                painter.save()
                painter.setBrush(QBrush(curve.pen().color(), Qt.SolidPattern))
                painter.drawPie(pieRect, int(-angle), int(-value))
                painter.restore()
                angle += value


class TimeScaleDraw(QwtScaleDraw):
    def __init__(self, baseTime, *args):
        QwtScaleDraw.__init__(self, *args)
        self.baseTime = baseTime

    def label(self, value):
        upTime = self.baseTime.addSecs(int(value))
        return QwtText(upTime.toString())


class Background(QwtPlotItem):
    def __init__(self):
        QwtPlotItem.__init__(self)
        self.setZ(0.0)

    def rtti(self):
        return QwtPlotItem.Rtti_PlotUserItem

    def draw(self, painter, xMap, yMap, rect):
        c = QColor(Qt.white)
        r = QRectF(rect)

        for i in range(100, 0, -10):
            r.setBottom(int(yMap.transform(i - 10)))
            r.setTop(int(yMap.transform(i)))
```

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```
            painter.fillRect(r, c)
            c = c.darker(110)


class CpuCurve(QwtPlotCurve):
    def __init__(self, *args):
        QwtPlotCurve.__init__(self, *args)
        self.setRenderHint(QwtPlotItem.RenderAntialiased)

    def setColor(self, color):
        c = QColor(color)
        c.setAlpha(150)

        self.setPen(c)
        self.setBrush(c)


class CpuPlot(QwtPlot):
    HISTORY = 60

    def __init__(self, unattended=False):
        QwtPlot.__init__(self)

        self.curves = {}
        self.data = {}
        self.timeData = 1.0 * np.arange(self.HISTORY - 1, -1, -1)
        self.cpuStat = CpuStat()

        self.setAutoReplot(False)

        self.plotLayout().setAlignCanvasToScales(True)

        legend = QwtLegend()
        legend.setDefaultItemMode(QwtLegendData.Checkable)
        self.insertLegend(legend, QwtPlot.RightLegend)

        self.setAxisTitle(QwtPlot.xBottom, "System Uptime [h:m:s]")
        self.setAxisScaleDraw(QwtPlot.xBottom, TimeScaleDraw(self.cpuStat.upTime()))
        self.setAxisScale(QwtPlot.xBottom, 0, self.HISTORY)
        self.setAxisLabelRotation(QwtPlot.xBottom, -50.0)
        self.setAxisLabelAlignment(QwtPlot.xBottom, Qt.AlignLeft | Qt.AlignBottom)

        self.setAxisTitle(QwtPlot.yLeft, "Cpu Usage [%]")
        self.setAxisScale(QwtPlot.yLeft, 0, 100)

        background = Background()
        background.attach(self)

        pie = CpuPieMarker()
        pie.attach(self)

        curve = CpuCurve("System")
```

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```
        curve.setColor(Qt.red)
        curve.attach(self)
        self.curves["System"] = curve
        self.data["System"] = np.zeros(self.HISTORY, float)

        curve = CpuCurve("User")
        curve.setColor(Qt.blue)
        curve.setZ(curve.z() - 1.0)
        curve.attach(self)
        self.curves["User"] = curve
        self.data["User"] = np.zeros(self.HISTORY, float)

        curve = CpuCurve("Total")
        curve.setColor(Qt.black)
        curve.setZ(curve.z() - 2.0)
        curve.attach(self)
        self.curves["Total"] = curve
        self.data["Total"] = np.zeros(self.HISTORY, float)

        curve = CpuCurve("Idle")
        curve.setColor(Qt.darkCyan)
        curve.setZ(curve.z() - 3.0)
        curve.attach(self)
        self.curves["Idle"] = curve
        self.data["Idle"] = np.zeros(self.HISTORY, float)

        self.showCurve(self.curves["System"], True)
        self.showCurve(self.curves["User"], True)
        self.showCurve(self.curves["Total"], False or unattended)
        self.showCurve(self.curves["Idle"], False or unattended)

        self.startTimer(20 if unattended else 1000)

        legend.checked.connect(self.showCurve)
        self.replot()

    def timerEvent(self, e):
        for data in self.data.values():
            data[1:] = data[0:-1]
        self.data["User"][0], self.data["System"][0] = self.cpuStat.statistic()
        self.data["Total"][0] = self.data["User"][0] + self.data["System"][0]
        self.data["Idle"][0] = 100.0 - self.data["Total"][0]

        self.timeData += 1.0

        self.setAxisScale(QwtPlot.xBottom, self.timeData[-1], self.timeData[0])
        for key in self.curves.keys():
            self.curves[key].setData(self.timeData, self.data[key])

        self.replot()

    def showCurve(self, item, on, index=None):
```

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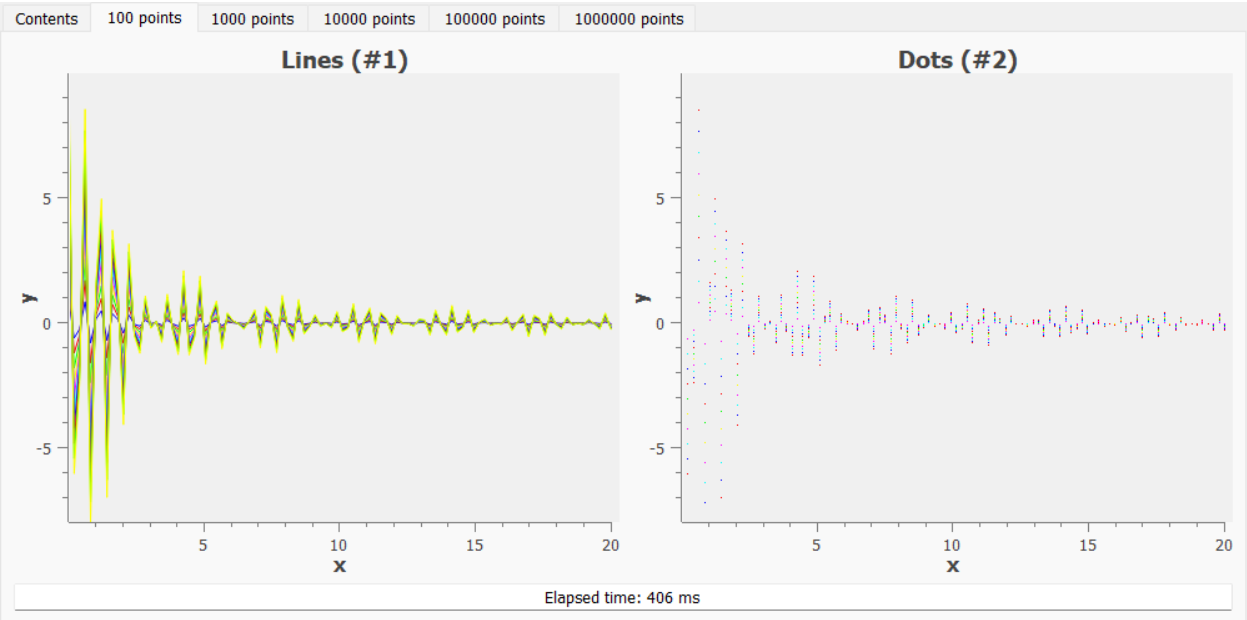
```
        item.setVisible(on)
        self.legend().legendWidget(item).setChecked(on)
        self.replot()

    def cpuPlotCurve(self, key):
        return self.curves[key]


class CpuDemo(QWidget):
    def __init__(self, parent=None, unattended=False):
        super(CpuDemo, self).__init__(parent)
        layout = QVBoxLayout()
        self.setLayout(layout)
        plot = CpuPlot(unattended=unattended)
        plot.setTitle("History")
        layout.addWidget(plot)
        label = QLabel("Press the legend to en/disable a curve")
        layout.addWidget(label)


def test_cpudemo():
    """CPU demo"""
    utils.test_widget(CpuDemo, (600, 400))


if __name__ == "__main__":
    test_cpudemo()
```

4.2.4 Curve benchmark demo 1



```
import time

import numpy as np
from qtpy.QtCore import Qt
from qtpy.QtWidgets import (
    QApplication,
    QGridLayout,
    QLineEdit,
    QMainWindow,
    QTabWidget,
    QTextEdit,
    QWidget,
)

from qwt import QwtPlot, QwtPlotCurve
from qwt.tests import utils

COLOR_INDEX = None


def get_curve_color():
    global COLOR_INDEX
    colors = (Qt.blue, Qt.red, Qt.green, Qt.yellow, Qt.magenta, Qt.cyan)
    if COLOR_INDEX is None:
        COLOR_INDEX = 0
    else:
        COLOR_INDEX = (COLOR_INDEX + 1) % len(colors)
    return colors[COLOR_INDEX]


PLOT_ID = 0


class BMPlot(QwtPlot):
    def __init__(self, title, xdata, ydata, style, symbol=None, *args):
        super(BMPlot, self).__init__(*args)
        global PLOT_ID
        self.setMinimumSize(200, 150)
        PLOT_ID += 1
        self.setTitle("%s (#%d)" % (title, PLOT_ID))
        self.setAxisTitle(QwtPlot.xBottom, "x")
        self.setAxisTitle(QwtPlot.yLeft, "y")
        self.curve_nb = 0
        for idx in range(1, 11):
            self.curve_nb += 1
            QwtPlotCurve.make(
                xdata,
                ydata * idx,
                style=style,
                symbol=symbol,
                linecolor=get_curve_color(),
                antialiased=True,
```

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```
                plot=self,
            )
        self.replot()


class BMWidget(QWidget):
    def __init__(self, nbcol, points, *args, **kwargs):
        super(BMWidget, self).__init__()
        self.plot_nb = 0
        self.curve_nb = 0
        self.setup(nbcol, points, *args, **kwargs)

    def params(self, *args, **kwargs):
        if kwargs.get("only_lines", False):
            return (("Lines", None),)
        else:
            return (
                ("Lines", None),
                ("Dots", None),
            )

    def setup(self, nbcol, points, *args, **kwargs):
        x = np.linspace(0.001, 20.0, int(points))
        y = (np.sin(x) / x) * np.cos(20 * x)
        layout = QGridLayout()
        col, row = 0, 0
        for style, symbol in self.params(*args, **kwargs):
            plot = BMPlot(style, x, y, getattr(QwtPlotCurve, style), symbol=symbol)
            layout.addWidget(plot, row, col)
            self.plot_nb += 1
            self.curve_nb += plot.curve_nb
            col += 1
            if col >= nbcol:
                row += 1
                col = 0
        self.text = QLineEdit()
        self.text.setReadOnly(True)
        self.text.setAlignment(Qt.AlignCenter)
        self.text.setText("Rendering plot...")
        layout.addWidget(self.text, row + 1, 0, 1, nbcol)
        self.setLayout(layout)


class BMText(QTextEdit):
    def __init__(self, parent=None, title=None):
        super(BMText, self).__init__(parent)
        self.setReadOnly(True)
        library = "PythonQwt"
        wintitle = self.parent().windowTitle()
        if not wintitle:
            wintitle = "Benchmark"
        if title is None:
```

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```
            title = "%s example" % wintitle
        self.parent().setWindowTitle("%s [%s]" % (wintitle, library))
        self.setText(
            """\
<b>%s:</b><br>
(base plotting library: %s)<br><br>
Click on each tab to test if plotting performance is acceptable in terms of
GUI response time (switch between tabs, resize main windows, ...).<br>
<br><br>
<b>Benchmarks results:</b>
"""
            % (title, library)
        )


class CurveBenchmark1(QMainWindow):
    TITLE = "Curve benchmark"
    SIZE = (1000, 500)

    def __init__(self, max_n=1000000, parent=None, unattended=False, **kwargs):
        super(CurveBenchmark1, self).__init__(parent=parent)
        title = self.TITLE
        if kwargs.get("only_lines", False):
            title = "%s (%s)" % (title, "only lines")
        self.setWindowTitle(title)
        self.tabs = QTabWidget()
        self.setCentralWidget(self.tabs)
        self.text = BMText(self)
        self.tabs.addTab(self.text, "Contents")
        self.resize(*self.SIZE)
        self.durations = []

        # Force window to show up and refresh (for test purpose only)
        self.show()
        QApplication.processEvents()

        t0g = time.time()
        self.run_benchmark(max_n, unattended, **kwargs)
        dt = time.time() - t0g
        self.text.append("<br><br><u>Total elapsed time</u>: %d ms" % (dt * 1e3))
        self.tabs.setCurrentIndex(1 if unattended else 0)

    def process_iteration(self, title, description, widget, t0):
        self.tabs.addTab(widget, title)
        self.tabs.setCurrentWidget(widget)

        # Force widget to refresh (for test purpose only)
        QApplication.processEvents()

        duration = (time.time() - t0) * 1000
        self.durations.append(duration)
        time_str = "Elapsed time: %d ms" % duration
```

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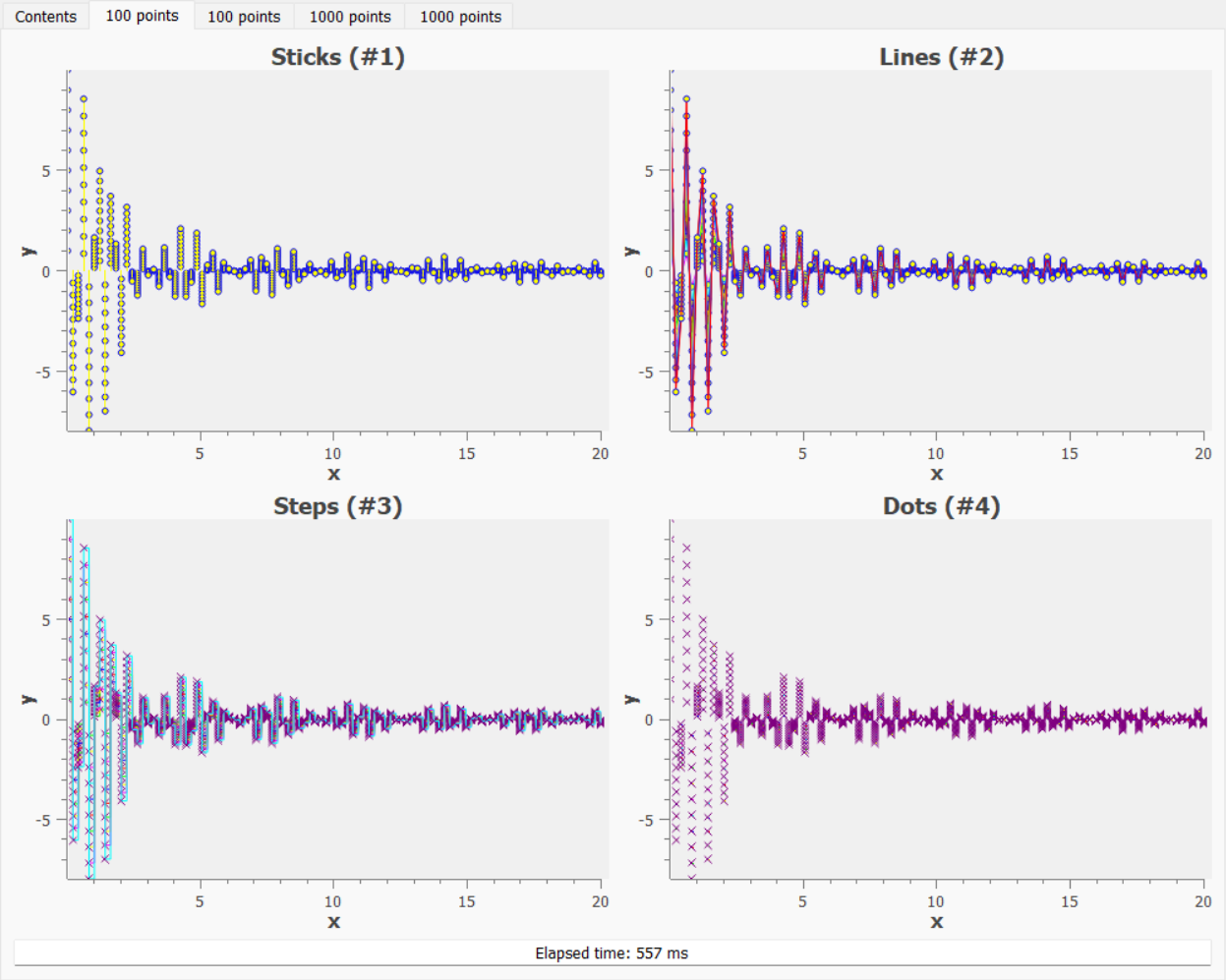
```
        widget.text.setText(time_str)
        self.text.append("<br><i>%s:</i><br>%s" % (description, time_str))
        print("[%s] %s" % (utils.get_lib_versions(), time_str))

    def run_benchmark(self, max_n, unattended, **kwargs):
        max_n = 1000 if unattended else max_n
        iterations = 0 if unattended else 4
        for idx in range(iterations, -1, -1):
            points = int(max_n / 10**idx)
            t0 = time.time()
            widget = BMWidget(2, points, **kwargs)
            title = "%d points" % points
            description = "%d plots with %d curves of %d points" % (
                widget.plot_nb,
                widget.curve_nb,
                points,
            )
            self.process_iteration(title, description, widget, t0)


def test_curvebenchmark1():
    """Curve benchmark example"""
    utils.test_widget(CurveBenchmark1, options=False)


if __name__ == "__main__":
    test_curvebenchmark1()
```

4.2.5 Curve benchmark demo 2




```
import time

from qtpy.QtCore import Qt

from qwt import QwtSymbol
from qwt.tests import test_curvebenchmark1 as cb
from qwt.tests import utils


class CSWidget(cb.BMWidget):
    def params(self, *args, **kwargs):
        (symbols,) = args
        symb1 = QwtSymbol.make(
            QwtSymbol.Ellipse, brush=Qt.yellow, pen=Qt.blue, size=(5, 5)
        )
        symb2 = QwtSymbol.make(QwtSymbol.XCross, pen=Qt.darkMagenta, size=(5, 5))
        if symbols:
            if kwargs.get("only_lines", False):
```

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```
                return (
                    ("Lines", symb1),
                    ("Lines", symb1),
                    ("Lines", symb2),
                    ("Lines", symb2),
                )
            else:
                return (
                    ("Sticks", symb1),
                    ("Lines", symb1),
                    ("Steps", symb2),
                    ("Dots", symb2),
                )
        else:
            if kwargs.get("only_lines", False):
                return (
                    ("Lines", None),
                    ("Lines", None),
                    ("Lines", None),
                    ("Lines", None),
                )
            else:
                return (
                    ("Sticks", None),
                    ("Lines", None),
                    ("Steps", None),
                    ("Dots", None),
                )


class CurveBenchmark2(cb.CurveBenchmark1):
    TITLE = "Curve styles"
    SIZE = (1000, 800)

    def __init__(self, max_n=1000, parent=None, unattended=False, **kwargs):
        super(CurveBenchmark2, self).__init__(
            max_n=max_n, parent=parent, unattended=unattended, **kwargs
        )

    def run_benchmark(self, max_n, unattended, **kwargs):
        for points, symbols in zip(
            (max_n / 10, max_n / 10, max_n, max_n), (True, False) * 2
        ):
            t0 = time.time()
            symtext = "with%s symbols" % ("" if symbols else "out")
            widget = CSWidget(2, points, symbols, **kwargs)
            title = "%d points" % points
            description = "%d plots with %d curves of %d points, %s" % (
                widget.plot_nb,
                widget.curve_nb,
                points,
                symtext,
```

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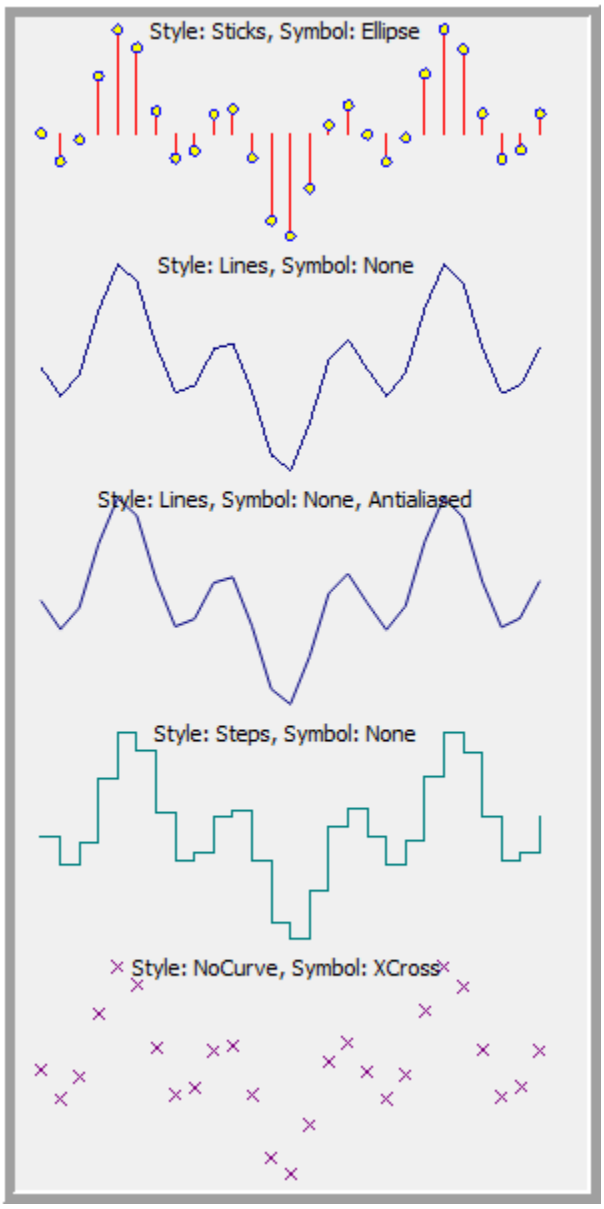
```
            )
            self.process_iteration(title, description, widget, t0)


def test_curvebenchmark2():
    """Curve styles benchmark example"""
    utils.test_widget(CurveBenchmark2, options=False)


if __name__ == "__main__":
    test_curvebenchmark2()
```

4.2.6 Curve demo 1



```
import numpy as np
from qtpy.QtCore import QSize, Qt
from qtpy.QtGui import QBrush, QFont, QPainter, QPen
from qtpy.QtWidgets import QFrame

from qwt import QwtPlotCurve, QwtPlotItem, QwtScaleMap, QwtSymbol
from qwt.tests import utils


class CurveDemo1(QFrame):
    def __init__(self, *args):
        QFrame.__init__(self, *args)

        self.xMap = QwtScaleMap()
        self.xMap.setScaleInterval(-0.5, 10.5)
        self.yMap = QwtScaleMap()
        self.yMap.setScaleInterval(-1.1, 1.1)

        # frame style
        self.setFrameStyle(QFrame.Box | QFrame.Raised)
        self.setLineWidth(2)
        self.setMidLineWidth(3)

        # calculate values
        self.x = np.arange(0, 10.0, 10.0 / 27)
        self.y = np.sin(self.x) * np.cos(2 * self.x)

        # make curves with different styles
        self.curves = []
        self.titles = []
        # curve 1
        self.titles.append("Style: Sticks, Symbol: Ellipse")
        curve = QwtPlotCurve()
        curve.setPen(QPen(Qt.red))
        curve.setStyle(QwtPlotCurve.Sticks)
        curve.setSymbol(
            QwtSymbol(QwtSymbol.Ellipse, QBrush(Qt.yellow), QPen(Qt.blue), QSize(5, 5))
        )
        self.curves.append(curve)
        # curve 2
        self.titles.append("Style: Lines, Symbol: None")
        curve = QwtPlotCurve()
        curve.setPen(QPen(Qt.darkBlue))
        curve.setStyle(QwtPlotCurve.Lines)
        self.curves.append(curve)
        # curve 3
        self.titles.append("Style: Lines, Symbol: None, Antialiased")
        curve = QwtPlotCurve()
        curve.setPen(QPen(Qt.darkBlue))
        curve.setStyle(QwtPlotCurve.Lines)
        curve.setRenderHint(QwtPlotItem.RenderAntialiased)
        self.curves.append(curve)
```

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```
        # curve 4
        self.titles.append("Style: Steps, Symbol: None")
        curve = QwtPlotCurve()
        curve.setPen(QPen(Qt.darkCyan))
        curve.setStyle(QwtPlotCurve.Steps)
        self.curves.append(curve)
        # curve 5
        self.titles.append("Style: NoCurve, Symbol: XCross")
        curve = QwtPlotCurve()
        curve.setStyle(QwtPlotCurve.NoCurve)
        curve.setSymbol(
            QwtSymbol(QwtSymbol.XCross, QBrush(), QPen(Qt.darkMagenta), QSize(5, 5))
        )
        self.curves.append(curve)

        # attach data, using Numeric
        for curve in self.curves:
            curve.setData(self.x, self.y)

    def shiftDown(self, rect, offset):
        rect.translate(0, offset)

    def paintEvent(self, event):
        QFrame.paintEvent(self, event)
        painter = QPainter(self)
        painter.setClipRect(self.contentsRect())
        self.drawContents(painter)

    def drawContents(self, painter):
        # draw curves
        r = self.contentsRect()
        dy = int(r.height() / len(self.curves))
        r.setHeight(dy)
        for curve in self.curves:
            self.xMap.setPaintInterval(r.left(), r.right())
            self.yMap.setPaintInterval(r.top(), r.bottom())
            painter.setRenderHint(
                QPainter.Antialiasing,
                curve.testRenderHint(QwtPlotItem.RenderAntialiased),
            )
            curve.draw(painter, self.xMap, self.yMap, r)
            self.shiftDown(r, dy)
        # draw titles
        r = self.contentsRect()
        r.setHeight(dy)
        painter.setFont(QFont("Helvetica", 8))
        painter.setPen(Qt.black)
        for title in self.titles:
            painter.drawText(
                0,
                r.top(),
                r.width(),
```

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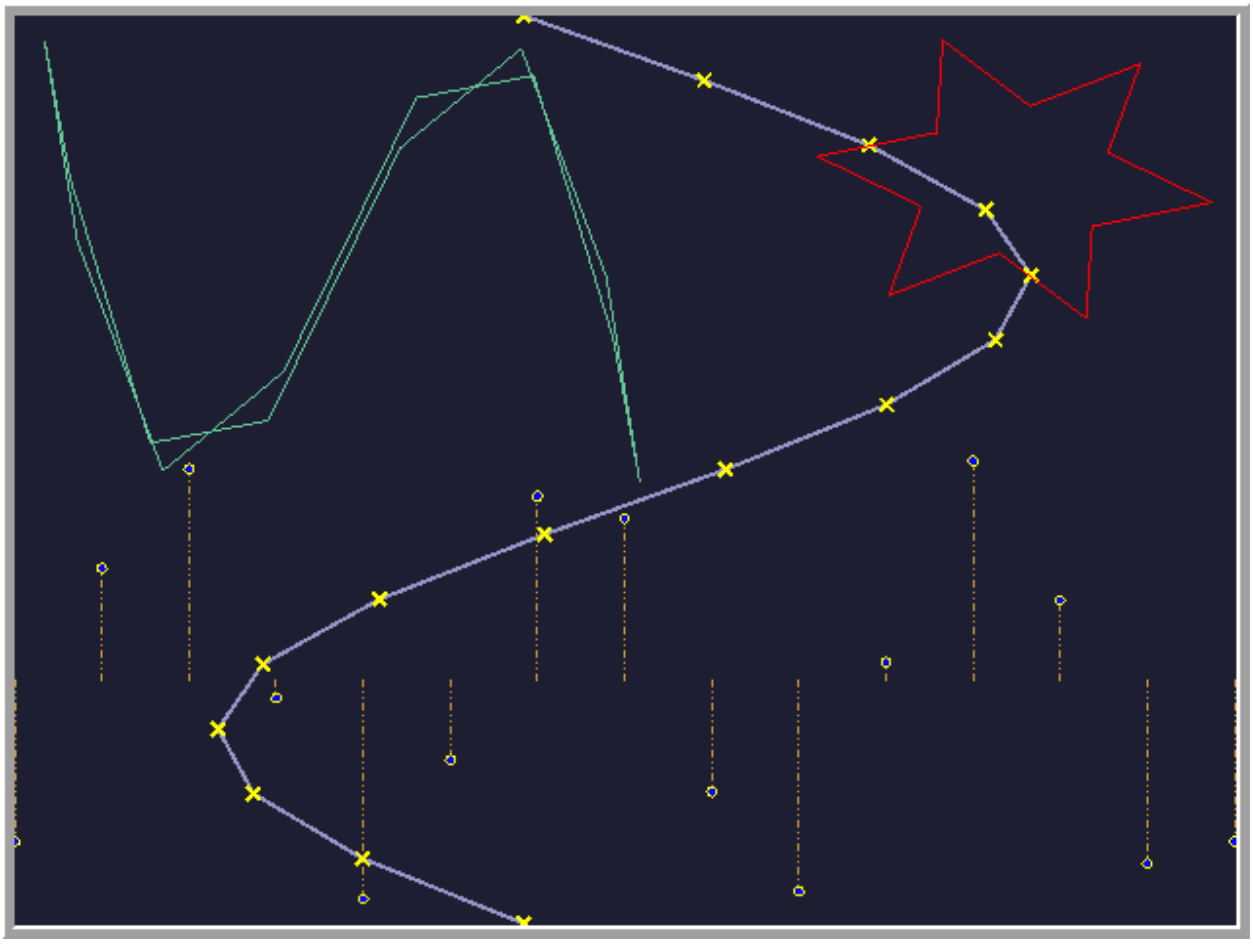
```
                painter.fontMetrics().height(),
                Qt.AlignTop | Qt.AlignHCenter,
                title,
            )
            self.shiftDown(r, dy)


def test_curvedemo1():
    """Curve demo 1"""
    utils.test_widget(CurveDemo1, size=(300, 600), options=False)


if __name__ == "__main__":
    test_curvedemo1()
```

4.2.7 Curve demo 2



```
import numpy as np
from qtpy.QtCore import QSize, Qt
from qtpy.QtGui import QBrush, QColor, QPainter, QPalette, QPen
```

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```
from qtpy.QtWidgets import QFrame

from qwt import QwtPlotCurve, QwtScaleMap, QwtSymbol
from qwt.tests import utils

Size = 15
USize = 13


class CurveDemo2(QFrame):
    def __init__(self, *args):
        QFrame.__init__(self, *args)

        self.setFrameStyle(QFrame.Box | QFrame.Raised)
        self.setLineWidth(2)
        self.setMidLineWidth(3)

        p = QPalette()
        p.setColor(self.backgroundRole(), QColor(30, 30, 50))
        self.setPalette(p)
        # make curves and maps
        self.tuples = []
        # curve 1
        curve = QwtPlotCurve()
        curve.setPen(QPen(QColor(150, 150, 200), 2))
        curve.setStyle(QwtPlotCurve.Lines)
        curve.setSymbol(
            QwtSymbol(QwtSymbol.XCross, QBrush(), QPen(Qt.yellow, 2), QSize(7, 7))
        )
        self.tuples.append(
            (curve, QwtScaleMap(0, 100, -1.5, 1.5), QwtScaleMap(0, 100, 0.0, 2 * np.pi))
        )
        # curve 2
        curve = QwtPlotCurve()
        curve.setPen(QPen(QColor(200, 150, 50), 1, Qt.DashDotDotLine))
        curve.setStyle(QwtPlotCurve.Sticks)
        curve.setSymbol(
            QwtSymbol(QwtSymbol.Ellipse, QBrush(Qt.blue), QPen(Qt.yellow), QSize(5, 5))
        )
        self.tuples.append(
            (curve, QwtScaleMap(0, 100, 0.0, 2 * np.pi), QwtScaleMap(0, 100, -3.0, 1.1))
        )
        # curve 3
        curve = QwtPlotCurve()
        curve.setPen(QPen(QColor(100, 200, 150)))
        curve.setStyle(QwtPlotCurve.Lines)
        self.tuples.append(
            (curve, QwtScaleMap(0, 100, -1.1, 3.0), QwtScaleMap(0, 100, -1.1, 3.0))
        )
        # curve 4
        curve = QwtPlotCurve()
        curve.setPen(QPen(Qt.red))
```

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```
        curve.setStyle(QwtPlotCurve.Lines)
        self.tuples.append(
            (curve, QwtScaleMap(0, 100, -5.0, 1.1), QwtScaleMap(0, 100, -1.1, 5.0))
        )
        # data
        self.phase = 0.0
        self.base = np.arange(0.0, 2.01 * np.pi, 2 * np.pi / (USize - 1))
        self.uval = np.cos(self.base)
        self.vval = np.sin(self.base)
        self.uval[1::2] *= 0.5
        self.vval[1::2] *= 0.5
        self.newValues()
        # start timer
        self.tid = self.startTimer(250)

    def paintEvent(self, event):
        QFrame.paintEvent(self, event)
        painter = QPainter(self)
        painter.setClipRect(self.contentsRect())
        self.drawContents(painter)

    def drawContents(self, painter):
        r = self.contentsRect()
        for curve, xMap, yMap in self.tuples:
            xMap.setPaintInterval(r.left(), r.right())
            yMap.setPaintInterval(r.top(), r.bottom())
            curve.draw(painter, xMap, yMap, r)

    def timerEvent(self, event):
        self.newValues()
        self.repaint()

    def newValues(self):
        phase = self.phase

        self.xval = np.arange(0, 2.01 * np.pi, 2 * np.pi / (Size - 1))
        self.yval = np.sin(self.xval - phase)
        self.zval = np.cos(3 * (self.xval + phase))

        s = 0.25 * np.sin(phase)
        c = np.sqrt(1.0 - s * s)
        u = self.uval
        self.uval = c * self.uval - s * self.vval
        self.vval = c * self.vval + s * u

        self.tuples[0][0].setData(self.yval, self.xval)
        self.tuples[1][0].setData(self.xval, self.zval)
        self.tuples[2][0].setData(self.yval, self.zval)
        self.tuples[3][0].setData(self.uval, self.vval)

        self.phase += 2 * np.pi / 100
        if self.phase > 2 * np.pi:
```

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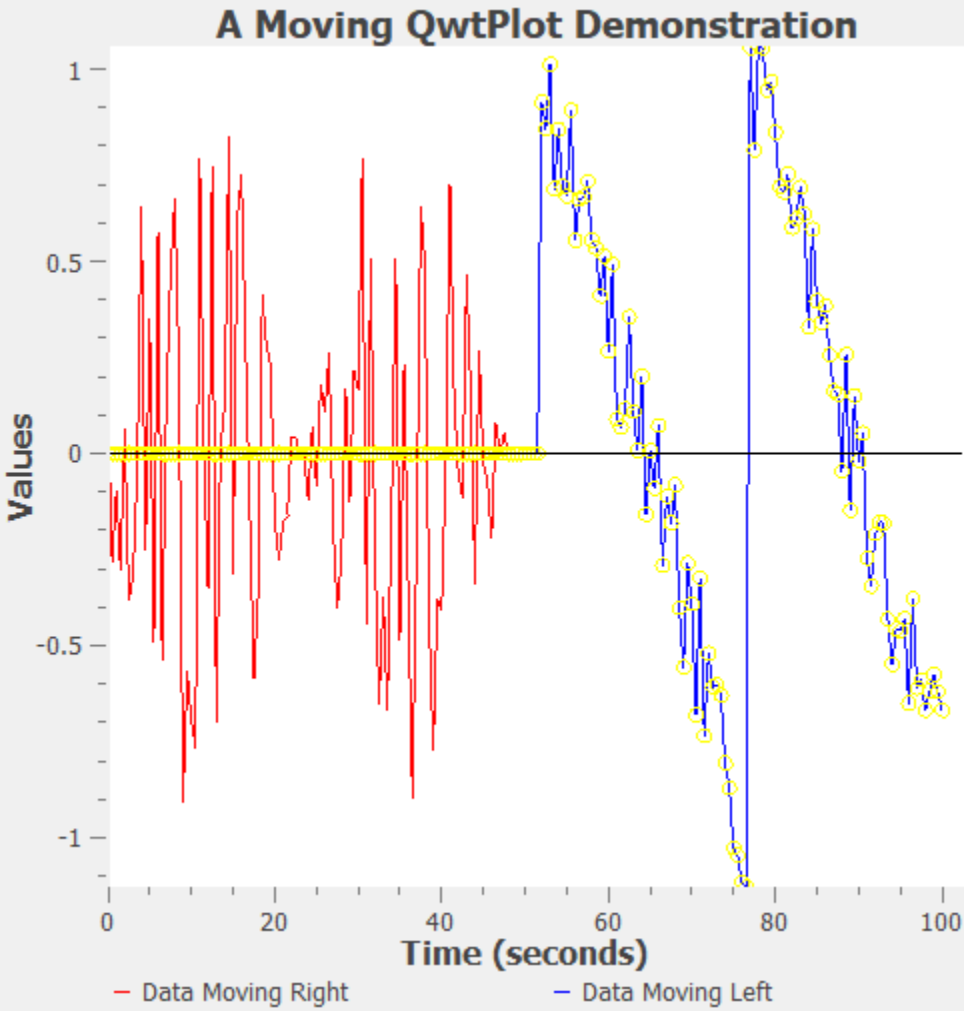
```
            self.phase = 0.0


def test_curvedemo2():
    """Curve demo 2"""
    utils.test_widget(CurveDemo2, options=False)


if __name__ == "__main__":
    test_curvedemo2()
```

4.2.8 Data demo




```
import random

import numpy as np
from qtpy.QtCore import QSize, Qt
from qtpy.QtGui import QBrush, QPen
```

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```
from qtpy.QtWidgets import QFrame

from qwt import (
    QwtAbstractScaleDraw,
    QwtLegend,
    QwtPlot,
    QwtPlotCurve,
    QwtPlotMarker,
    QwtSymbol,
)
from qwt.tests import utils


class DataPlot(QwtPlot):
    def __init__(self, unattended=False):
        QwtPlot.__init__(self)

        self.setCanvasBackground(Qt.white)
        self.alignScales()

        # Initialize data
        self.x = np.arange(0.0, 100.1, 0.5)
        self.y = np.zeros(len(self.x), float)
        self.z = np.zeros(len(self.x), float)

        self.setTitle("A Moving QwtPlot Demonstration")
        self.insertLegend(QwtLegend(), QwtPlot.BottomLegend)

        self.curveR = QwtPlotCurve("Data Moving Right")
        self.curveR.attach(self)
        self.curveL = QwtPlotCurve("Data Moving Left")
        self.curveL.attach(self)

        self.curveL.setSymbol(
            QwtSymbol(QwtSymbol.Ellipse, QBrush(), QPen(Qt.yellow), QSize(7, 7))
        )

        self.curveR.setPen(QPen(Qt.red))
        self.curveL.setPen(QPen(Qt.blue))

        mY = QwtPlotMarker()
        mY.setLabelAlignment(Qt.AlignRight | Qt.AlignTop)
        mY.setLineStyle(QwtPlotMarker.HLine)
        mY.setYValue(0.0)
        mY.attach(self)

        self.setAxisTitle(QwtPlot.xBottom, "Time (seconds)")
        self.setAxisTitle(QwtPlot.yLeft, "Values")

        self.startTimer(10 if unattended else 50)
        self.phase = 0.0
```

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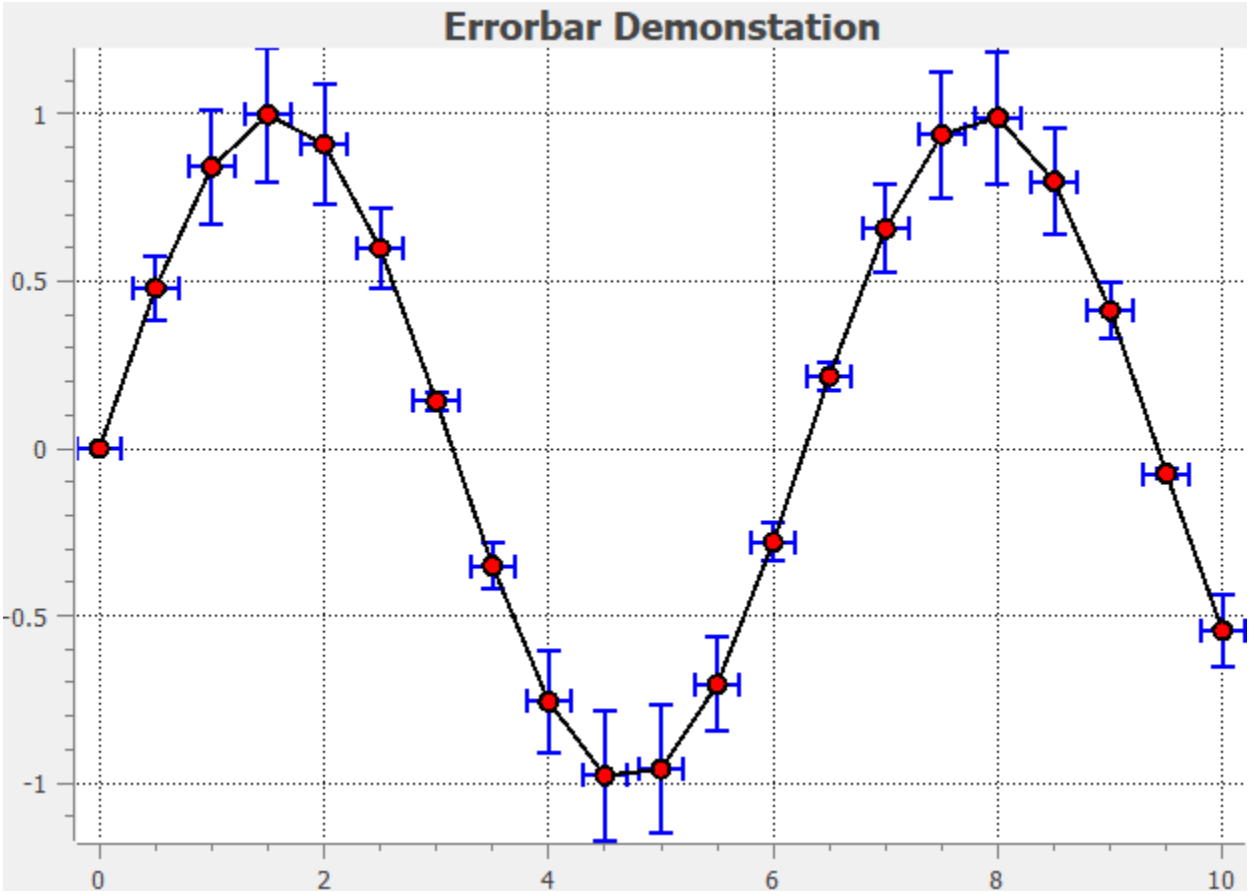
```
    def alignScales(self):
        self.canvas().setFrameStyle(QFrame.Box | QFrame.Plain)
        self.canvas().setLineWidth(1)
        for axis_id in QwtPlot.AXES:
            scaleWidget = self.axisWidget(axis_id)
            if scaleWidget:
                scaleWidget.setMargin(0)
            scaleDraw = self.axisScaleDraw(axis_id)
            if scaleDraw:
                scaleDraw.enableComponent(QwtAbstractScaleDraw.Backbone, False)

    def timerEvent(self, e):
        if self.phase > np.pi - 0.0001:
            self.phase = 0.0

        # y moves from left to right:
        # shift y array right and assign new value y[0]
        self.y = np.concatenate((self.y[:1], self.y[:-1]))
        self.y[0] = np.sin(self.phase) * (-1.0 + 2.0 * random.random())

        # z moves from right to left:
        # Shift z array left and assign new value to z[n-1].
        self.z = np.concatenate((self.z[1:], self.z[:1]))
        self.z[-1] = 0.8 - (2.0 * self.phase / np.pi) + 0.4 * random.random()

        self.curveR.setData(self.x, self.y)
        self.curveL.setData(self.x, self.z)

        self.replot()
        self.phase += np.pi * 0.02


def test_data():
    """Data Test"""
    utils.test_widget(DataPlot, size=(500, 300))


if __name__ == "__main__":
    test_data()
```

4.2.9 Error bar demo




```
import numpy as np
from qtpy.QtCore import QLineF, QRectF, QSize, Qt
from qtpy.QtGui import QBrush, QPen

from qwt import QwtPlot, QwtPlotCurve, QwtPlotGrid, QwtSymbol
from qwt.tests import utils


class ErrorBarPlotCurve(QwtPlotCurve):
    def __init__(
        self,
        x=[],
        y=[],
        dx=None,
        dy=None,
        curvePen=None,
        curveStyle=None,
        curveSymbol=None,
        errorPen=None,
        errorCap=0,
        errorOnTop=False,
    ):
```

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```
        """A curve of x versus y data with error bars in dx and dy.

        Horizontal error bars are plotted if dx is not None.
        Vertical error bars are plotted if dy is not None.

        x and y must be sequences with a shape (N,) and dx and dy must be
        sequences (if not None) with a shape (), (N,), or (2, N):
        - if dx or dy has a shape () or (N,), the error bars are given by
          (x-dx, x+dx) or (y-dy, y+dy),
        - if dx or dy has a shape (2, N), the error bars are given by
          (x-dx[0], x+dx[1]) or (y-dy[0], y+dy[1]).

        curvePen is the pen used to plot the curve

        curveStyle is the style used to plot the curve

        curveSymbol is the symbol used to plot the symbols

        errorPen is the pen used to plot the error bars

        errorCap is the size of the error bar caps

        errorOnTop is a boolean:
        - if True, plot the error bars on top of the curve,
        - if False, plot the curve on top of the error bars.
        """

        QwtPlotCurve.__init__(self)

        if curvePen is None:
            curvePen = QPen(Qt.NoPen)
        if curveStyle is None:
            curveStyle = QwtPlotCurve.Lines
        if curveSymbol is None:
            curveSymbol = QwtSymbol()
        if errorPen is None:
            errorPen = QPen(Qt.NoPen)

        self.setData(x, y, dx, dy)
        self.setPen(curvePen)
        self.setStyle(curveStyle)
        self.setSymbol(curveSymbol)
        self.errorPen = errorPen
        self.errorCap = errorCap
        self.errorOnTop = errorOnTop

    def setData(self, *args):
        """Set x versus y data with error bars in dx and dy.

        Horizontal error bars are plotted if dx is not None.
        Vertical error bars are plotted if dy is not None.
```

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```
        x and y must be sequences with a shape (N,) and dx and dy must be
        sequences (if not None) with a shape (), (N,), or (2, N):
        - if dx or dy has a shape () or (N,), the error bars are given by
          (x-dx, x+dx) or (y-dy, y+dy),
        - if dx or dy has a shape (2, N), the error bars are given by
          (x-dx[0], x+dx[1]) or (y-dy[0], y+dy[1]).
        """
        if len(args) == 1:
            QwtPlotCurve.setData(self, *args)
            return

        dx = None
        dy = None
        x, y = args[:2]
        if len(args) > 2:
            dx = args[2]
            if len(args) > 3:
                dy = args[3]

        self.__x = np.asarray(x, float)
        if len(self.__x.shape) != 1:
            raise RuntimeError("len(asarray(x).shape) != 1")

        self.__y = np.asarray(y, float)
        if len(self.__y.shape) != 1:
            raise RuntimeError("len(asarray(y).shape) != 1")
        if len(self.__x) != len(self.__y):
            raise RuntimeError("len(asarray(x)) != len(asarray(y))")

        if dx is None:
            self.__dx = None
        else:
            self.__dx = np.asarray(dx, float)
        if len(self.__dx.shape) not in [0, 1, 2]:
            raise RuntimeError("len(asarray(dx).shape) not in [0, 1, 2]")

        if dy is None:
            self.__dy = dy
        else:
            self.__dy = np.asarray(dy, float)
        if len(self.__dy.shape) not in [0, 1, 2]:
            raise RuntimeError("len(asarray(dy).shape) not in [0, 1, 2]")

        QwtPlotCurve.setData(self, self.__x, self.__y)

    def boundingRect(self):
        """Return the bounding rectangle of the data, error bars included."""
        if self.__dx is None:
            xmin = min(self.__x)
            xmax = max(self.__x)
        elif len(self.__dx.shape) in [0, 1]:
            xmin = min(self.__x - self.__dx)
```

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```
            xmax = max(self.__x + self.__dx)
        else:
            xmin = min(self.__x - self.__dx[0])
            xmax = max(self.__x + self.__dx[1])

        if self.__dy is None:
            ymin = min(self.__y)
            ymax = max(self.__y)
        elif len(self.__dy.shape) in [0, 1]:
            ymin = min(self.__y - self.__dy)
            ymax = max(self.__y + self.__dy)
        else:
            ymin = min(self.__y - self.__dy[0])
            ymax = max(self.__y + self.__dy[1])

        return QRectF(xmin, ymin, xmax - xmin, ymax - ymin)

    def drawSeries(self, painter, xMap, yMap, canvasRect, first, last=-1):
        """Draw an interval of the curve, including the error bars

        painter is the QPainter used to draw the curve

        xMap is the QwtDiMap used to map x-values to pixels

        yMap is the QwtDiMap used to map y-values to pixels

        first is the index of the first data point to draw

        last is the index of the last data point to draw. If last < 0, last
        is transformed to index the last data point
        """

        if last < 0:
            last = self.dataSize() - 1

        if self.errorOnTop:
            QwtPlotCurve.drawSeries(self, painter, xMap, yMap, canvasRect, first, last)

        # draw the error bars
        painter.save()
        painter.setPen(self.errorPen)

        # draw the error bars with caps in the x direction
        if self.__dx is not None:
            # draw the bars
            if len(self.__dx.shape) in [0, 1]:
                xmin = self.__x - self.__dx
                xmax = self.__x + self.__dx
            else:
                xmin = self.__x - self.__dx[0]
                xmax = self.__x + self.__dx[1]
            y = self.__y
```

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```
            n, i = len(y), 0
            lines = []
            while i < n:
                yi = yMap.transform(y[i])
                lines.append(
                    QLineF(xMap.transform(xmin[i]), yi, xMap.transform(xmax[i]), yi)
                )
                i += 1
            painter.drawLines(lines)
            if self.errorCap > 0:
                # draw the caps
                cap = self.errorCap / 2
                (
                    n,
                    i,
                ) = (
                    len(y),
                    0,
                )
                lines = []
                while i < n:
                    yi = yMap.transform(y[i])
                    lines.append(
                        QLineF(
                            xMap.transform(xmin[i]),
                            yi - cap,
                            xMap.transform(xmin[i]),
                            yi + cap,
                        )
                    )
                    lines.append(
                        QLineF(
                            xMap.transform(xmax[i]),
                            yi - cap,
                            xMap.transform(xmax[i]),
                            yi + cap,
                        )
                    )
                    i += 1
                painter.drawLines(lines)

        # draw the error bars with caps in the y direction
        if self.__dy is not None:
            # draw the bars
            if len(self.__dy.shape) in [0, 1]:
                ymin = self.__y - self.__dy
                ymax = self.__y + self.__dy
            else:
                ymin = self.__y - self.__dy[0]
                ymax = self.__y + self.__dy[1]
            x = self.__x
            (
```

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```
                n,
                i,
            ) = (
                len(x),
                0,
            )
            lines = []
            while i < n:
                xi = xMap.transform(x[i])
                lines.append(
                    QLineF(xi, yMap.transform(ymin[i]), xi, yMap.transform(ymax[i]))
                )
                i += 1
            painter.drawLines(lines)
            # draw the caps
            if self.errorCap > 0:
                cap = self.errorCap / 2
                n, i, _j = len(x), 0, 0
                lines = []
                while i < n:
                    xi = xMap.transform(x[i])
                    lines.append(
                        QLineF(
                            xi - cap,
                            yMap.transform(ymin[i]),
                            xi + cap,
                            yMap.transform(ymin[i]),
                        )
                    )
                    lines.append(
                        QLineF(
                            xi - cap,
                            yMap.transform(ymax[i]),
                            xi + cap,
                            yMap.transform(ymax[i]),
                        )
                    )
                    i += 1
                painter.drawLines(lines)

        painter.restore()

        if not self.errorOnTop:
            QwtPlotCurve.drawSeries(self, painter, xMap, yMap, canvasRect, first, last)


class ErrorBarPlot(QwtPlot):
    def __init__(self, parent=None, title=None):
        super(ErrorBarPlot, self).__init__("Errorbar Demonstation")
        self.setCanvasBackground(Qt.white)
        self.plotLayout().setAlignCanvasToScales(True)
        grid = QwtPlotGrid()
```

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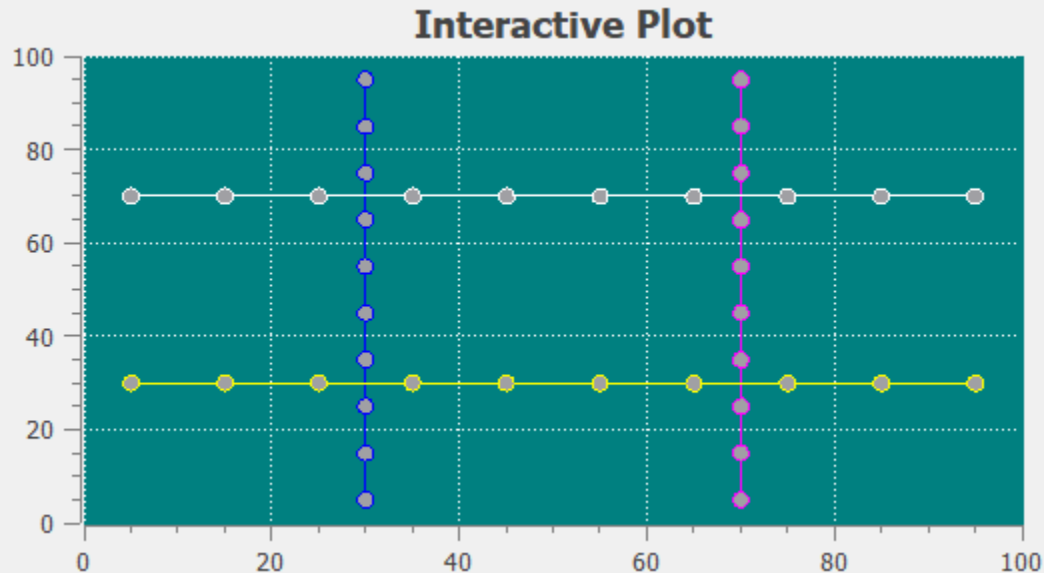
```
        grid.attach(self)
        grid.setPen(QPen(Qt.black, 0, Qt.DotLine))

        # calculate data and errors for a curve with error bars
        x = np.arange(0, 10.1, 0.5, float)
        y = np.sin(x)
        dy = 0.2 * abs(y)
        # dy = (0.15 * abs(y), 0.25 * abs(y)) # uncomment for asymmetric error bars
        dx = 0.2  # all error bars the same size
        errorOnTop = False  # uncomment to draw the curve on top of the error bars
        # errorOnTop = True # uncomment to draw the error bars on top of the curve
        symbol = QwtSymbol(
            QwtSymbol.Ellipse, QBrush(Qt.red), QPen(Qt.black, 2), QSize(9, 9)
        )
        curve = ErrorBarPlotCurve(
            x=x,
            y=y,
            dx=dx,
            dy=dy,
            curvePen=QPen(Qt.black, 2),
            curveSymbol=symbol,
            errorPen=QPen(Qt.blue, 2),
            errorCap=10,
            errorOnTop=errorOnTop,
        )
        curve.attach(self)


def test_errorbar():
    """Errorbar plot example"""
    utils.test_widget(ErrorBarPlot, size=(640, 480))


if __name__ == "__main__":
    test_errorbar()
```

4.2.10 Event filter demo




```
import os

import numpy as np
from qtpy.QtCore import QEvent, QObject, QPoint, QRect, QSize, Qt, Signal
from qtpy.QtGui import QBrush, QColor, QPainter, QPen
from qtpy.QtWidgets import QApplication, QMainWindow, QToolBar, QWhatsThis, QWidget

from qwt import (
    QwtPlot,
    QwtPlotCanvas,
    QwtPlotCurve,
    QwtPlotGrid,
    QwtScaleDiv,
    QwtScaleDraw,
    QwtSymbol,
)
from qwt.tests import utils

QT_API = os.environ["QT_API"]


class ColorBar(QWidget):
    colorSelected = Signal(QColor)

    def __init__(self, orientation, *args):
        QWidget.__init__(self, *args)
        self.__orientation = orientation
        self.__light = QColor(Qt.white)
        self.__dark = QColor(Qt.black)
        self.setCursor(Qt.PointingHandCursor)
```

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```
    def setOrientation(self, orientation):
        self.__orientation = orientation
        self.update()

    def orientation(self):
        return self.__orientation

    def setRange(self, light, dark):
        self.__light = light
        self.__dark = dark
        self.update()

    def setLight(self, color):
        self.__light = color
        self.update()

    def setDark(self, color):
        self.__dark = color
        self.update()

    def light(self):
        return self.__light

    def dark(self):
        return self.__dark

    def mousePressEvent(self, event):
        if event.button() == Qt.LeftButton:
            pm = self.grab()
            color = QColor()
            color.setRgb(pm.toImage().pixel(event.x(), event.y()))
            self.colorSelected.emit(color)
            event.accept()

    def paintEvent(self, _):
        painter = QPainter(self)
        self.drawColorBar(painter, self.rect())

    def drawColorBar(self, painter, rect):
        h1, s1, v1, _ = self.__light.getHsv()
        h2, s2, v2, _ = self.__dark.getHsv()
        painter.save()
        painter.setClipRect(rect)
        painter.setClipping(True)
        painter.fillRect(rect, QBrush(self.__dark))
        sectionSize = 2
        if self.__orientation == Qt.Horizontal:
            numIntervals = rect.width() / sectionSize
        else:
            numIntervals = rect.height() / sectionSize
        section = QRect()
        for i in range(int(numIntervals)):
```

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```
            if self.__orientation == Qt.Horizontal:
                section.setRect(
                    rect.x() + i * sectionSize, rect.y(), sectionSize, rect.heigh()
                )
            else:
                section.setRect(
                    rect.x(), rect.y() + i * sectionSize, rect.width(), sectionSize
                )
            ratio = float(i) / float(numIntervals)
            color = QColor()
            color.setHsv(
                h1 + int(ratio * (h2 - h1) + 0.5),
                s1 + int(ratio * (s2 - s1) + 0.5),
                v1 + int(ratio * (v2 - v1) + 0.5),
            )
            painter.fillRect(section, color)
        painter.restore()


class Plot(QwtPlot):
    def __init__(self, *args):
        QwtPlot.__init__(self, *args)

        self.setTitle("Interactive Plot")

        self.setCanvasColor(Qt.darkCyan)

        grid = QwtPlotGrid()
        grid.attach(self)
        grid.setMajorPen(QPen(Qt.white, 0, Qt.DotLine))

        self.setAxisScale(QwtPlot.xBottom, 0.0, 100.0)
        self.setAxisScale(QwtPlot.yLeft, 0.0, 100.0)

        # Avoid jumping when label with 3 digits
        # appear/disappear when scrolling vertically
        scaleDraw = self.axisScaleDraw(QwtPlot.yLeft)
        scaleDraw.setMinimumExtent(
            scaleDraw.extent(self.axisWidget(QwtPlot.yLeft).font())
        )

        self.plotLayout().setAlignCanvasToScales(True)

        self.__insertCurve(Qt.Vertical, Qt.blue, 30.0)
        self.__insertCurve(Qt.Vertical, Qt.magenta, 70.0)
        self.__insertCurve(Qt.Horizontal, Qt.yellow, 30.0)
        self.__insertCurve(Qt.Horizontal, Qt.white, 70.0)

        self.replot()

        scaleWidget = self.axisWidget(QwtPlot.yLeft)
        scaleWidget.setMargin(10)
```

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```
        self.__colorBar = ColorBar(Qt.Vertical, scaleWidget)
        self.__colorBar.setRange(QColor(Qt.red), QColor(Qt.darkBlue))
        self.__colorBar.setFocusPolicy(Qt.TabFocus)
        self.__colorBar.colorSelected.connect(self.setCanvasColor)

        # we need the resize events, to lay out the color bar
        scaleWidget.installEventFilter(self)

        # we need the resize events, to lay out the wheel
        self.canvas().installEventFilter(self)

        scaleWidget.setWhatsThis(
            "Selecting a value at the scale will insert a new curve."
        )
        self.__colorBar.setWhatsThis(
            "Selecting a color will change the background of the plot."
        )
        self.axisWidget(QwtPlot.xBottom).setWhatsThis(
            "Selecting a value at the scale will insert a new curve."
        )

    def setCanvasColor(self, color):
        self.setCanvasBackground(color)
        self.replot()

    def scrollLeftAxis(self, value):
        self.setAxisScale(QwtPlot.yLeft, value, value + 100)
        self.replot()

    def eventFilter(self, obj, event):
        if event.type() == QEvent.Resize:
            size = event.size()
            if obj == self.axisWidget(QwtPlot.yLeft):
                margin = 2
                x = size.width() - obj.margin() + margin
                w = obj.margin() - 2 * margin
                y = int(obj.startBorderDist())
                h = int(size.height() - obj.startBorderDist() - obj.endBorderDist())
                self.__colorBar.setGeometry(x, y, w, h)
        return QwtPlot.eventFilter(self, obj, event)

    def insertCurve(self, axis, base):
        if axis == QwtPlot.yLeft or axis == QwtPlot.yRight:
            o = Qt.Horizontal
        else:
            o = Qt.Vertical
        self.__insertCurve(o, QColor(Qt.red), base)
        self.replot()

    def __insertCurve(self, orientation, color, base):
        curve = QwtPlotCurve()
```

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```
        curve.attach(self)
        curve.setPen(QPen(color))
        curve.setSymbol(
            QwtSymbol(QwtSymbol.Ellipse, QBrush(Qt.gray), QPen(color), QSize(8, 8))
        )
        fixed = base * np.ones(10, float)
        changing = np.arange(0, 95.0, 10.0, float) + 5.0
        if orientation == Qt.Horizontal:
            curve.setData(changing, fixed)
        else:
            curve.setData(fixed, changing)


class CanvasPicker(QObject):
    def __init__(self, plot):
        QObject.__init__(self, plot)
        self.__selectedCurve = None
        self.__selectedPoint = -1
        self.__plot = plot
        canvas = plot.canvas()
        canvas.installEventFilter(self)
        # We want the focus, but no focus rect.
        # The selected point will be highlighted instead.
        canvas.setFocusPolicy(Qt.StrongFocus)
        canvas.setCursor(Qt.PointingHandCursor)
        canvas.setFocusIndicator(QwtPlotCanvas.ItemFocusIndicator)
        canvas.setFocus()
        canvas.setWhatsThis(
            "All points can be moved using the left mouse button "
            "or with these keys:\n\n"
            "- Up: Select next curve\n"
            "- Down: Select previous curve\n"
            '- Left, "-": Select next point\n'
            '- Right, "+": Select previous point\n'
            "- 7, 8, 9, 4, 6, 1, 2, 3: Move selected point"
        )
        self.__shiftCurveCursor(True)

    def event(self, event):
        if event.type() == QEvent.User:
            self.__showCursor(True)
            return True
        return QObject.event(self, event)

    def eventFilter(self, object, event):
        if event.type() == QEvent.FocusIn:
            self.__showCursor(True)
        if event.type() == QEvent.FocusOut:
            try:
                self.__showCursor(False)
            except RuntimeError:
                pass  # ignore error when closing the application
```

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```
        if event.type() == QEvent.Paint:
            QApplication.postEvent(self, QEvent(QEvent.User))
        elif event.type() == QEvent.MouseButtonPress:
            self.__select(event.position())
            return True
        elif event.type() == QEvent.MouseMove:
            self.__move(event.position())
            return True
        if event.type() == QEvent.KeyPress:
            delta = 5
            key = event.key()
            if key == Qt.Key_Up:
                self.__shiftCurveCursor(True)
                return True
            elif key == Qt.Key_Down:
                self.__shiftCurveCursor(False)
                return True
            elif key == Qt.Key_Right or key == Qt.Key_Plus:
                if self.__selectedCurve:
                    self.__shiftPointCursor(True)
                else:
                    self.__shiftCurveCursor(True)
                return True
            elif key == Qt.Key_Left or key == Qt.Key_Minus:
                if self.__selectedCurve:
                    self.__shiftPointCursor(False)
                else:
                    self.__shiftCurveCursor(True)
                return True
            if key == Qt.Key_1:
                self.__moveBy(-delta, delta)
            elif key == Qt.Key_2:
                self.__moveBy(0, delta)
            elif key == Qt.Key_3:
                self.__moveBy(delta, delta)
            elif key == Qt.Key_4:
                self.__moveBy(-delta, 0)
            elif key == Qt.Key_6:
                self.__moveBy(delta, 0)
            elif key == Qt.Key_7:
                self.__moveBy(-delta, -delta)
            elif key == Qt.Key_8:
                self.__moveBy(0, -delta)
            elif key == Qt.Key_9:
                self.__moveBy(delta, -delta)
        return False

    def __select(self, pos):
        found, distance, point = None, 1e100, -1
        for curve in self.__plot.itemList():
            if isinstance(curve, QwtPlotCurve):
                i, d = curve.closestPoint(pos)
```

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```
                if d < distance:
                    found = curve
                    point = i
                    distance = d
        self.__showCursor(False)
        self.__selectedCurve = None
        self.__selectedPoint = -1
        if found and distance < 10:
            self.__selectedCurve = found
            self.__selectedPoint = point
            self.__showCursor(True)

    def __moveBy(self, dx, dy):
        if dx == 0 and dy == 0:
            return
        curve = self.__selectedCurve
        if not curve:
            return
        s = curve.sample(self.__selectedPoint)
        x = self.__plot.transform(curve.xAxis(), s.x()) + dx
        y = self.__plot.transform(curve.yAxis(), s.y()) + dy
        self.__move(QPoint(x, y))

    def __move(self, pos):
        curve = self.__selectedCurve
        if not curve:
            return
        xData = np.zeros(curve.dataSize(), float)
        yData = np.zeros(curve.dataSize(), float)
        for i in range(curve.dataSize()):
            if i == self.__selectedPoint:
                xData[i] = self.__plot.invTransform(curve.xAxis(), pos.x())
                yData[i] = self.__plot.invTransform(curve.yAxis(), pos.y())
            else:
                s = curve.sample(i)
                xData[i] = s.x()
                yData[i] = s.y()
        curve.setData(xData, yData)
        self.__showCursor(True)
        self.__plot.replot()

    def __showCursor(self, showIt):
        curve = self.__selectedCurve
        if not curve:
            return
        symbol = curve.symbol()
        brush = symbol.brush()
        if showIt:
            symbol.setBrush(symbol.brush().color().darker(180))
        curve.directPaint(self.__selectedPoint, self.__selectedPoint)
        if showIt:
            symbol.setBrush(brush)
```

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```
    def __shiftCurveCursor(self, up):
        curves = [
            curve for curve in self.__plot.itemList() if isinstance(curve, QwtPlotCurve)
        ]
        if not curves:
            return
        if self.__selectedCurve in curves:
            index = curves.index(self.__selectedCurve)
            if up:
                index += 1
            else:
                index -= 1
            # keep index within [0, len(curves))
            index += len(curves)
            index %= len(curves)
        else:
            index = 0
        self.__showCursor(False)
        self.__selectedPoint = 0
        self.__selectedCurve = curves[index]
        self.__showCursor(True)

    def __shiftPointCursor(self, up):
        curve = self.__selectedCurve
        if not curve:
            return
        if up:
            index = self.__selectedPoint + 1
        else:
            index = self.__selectedPoint - 1
        # keep index within [0, curve.dataSize())
        index += curve.dataSize()
        index %= curve.dataSize()
        if index != self.__selectedPoint:
            self.__showCursor(False)
            self.__selectedPoint = index
            self.__showCursor(True)


class ScalePicker(QObject):
    clicked = Signal(int, float)

    def __init__(self, plot):
        QObject.__init__(self, plot)
        for axis_id in QwtPlot.AXES:
            scaleWidget = plot.axisWidget(axis_id)
            if scaleWidget:
                scaleWidget.installEventFilter(self)

    def eventFilter(self, object, event):
        if event.type() == QEvent.MouseButtonPress:
```

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```
            self.__mouseClicked(object, event.position())
            return True
        return QObject.eventFilter(self, object, event)

    def __mouseClicked(self, scale, pos):
        rect = self.__scaleRect(scale)
        margin = 10
        rect.setRect(
            rect.x() - margin,
            rect.y() - margin,
            rect.width() + 2 * margin,
            rect.height() + 2 * margin,
        )
        if rect.contains(pos):
            value = 0.0
            axis = -1
        sd = scale.scaleDraw()
        if scale.alignment() == QwtScaleDraw.LeftScale:
            value = sd.scaleMap().invTransform(pos.y())
            axis = QwtPlot.yLeft
        elif scale.alignment() == QwtScaleDraw.RightScale:
            value = sd.scaleMap().invTransform(pos.y())
            axis = QwtPlot.yRight
        elif scale.alignment() == QwtScaleDraw.BottomScale:
            value = sd.scaleMap().invTransform(pos.x())
            axis = QwtPlot.xBottom
        elif scale.alignment() == QwtScaleDraw.TopScale:
            value = sd.scaleMap().invTransform(pos.x())
            axis = QwtPlot.xBottom
        self.clicked.emit(axis, value)

    def __scaleRect(self, scale):
        bld = scale.margin()
        mjt = scale.scaleDraw().tickLength(QwtScaleDiv.MajorTick)
        sbd = scale.startBorderDist()
        ebd = scale.endBorderDist()
        if scale.alignment() == QwtScaleDraw.LeftScale:
            return QRect(
                scale.width() - bld - mjt, sbd, mjt, scale.height() - sbd - ebd
            )
        elif scale.alignment() == QwtScaleDraw.RightScale:
            return QRect(bld, sbd, mjt, scale.height() - sbd - ebd)
        elif scale.alignment() == QwtScaleDraw.BottomScale:
            return QRect(sbd, bld, scale.width() - sbd - ebd, mjt)
        elif scale.alignment() == QwtScaleDraw.TopScale:
            return QRect(
                sbd, scale.height() - bld - mjt, scale.width() - sbd - ebd, mjt
            )
        else:
            return QRect()
```

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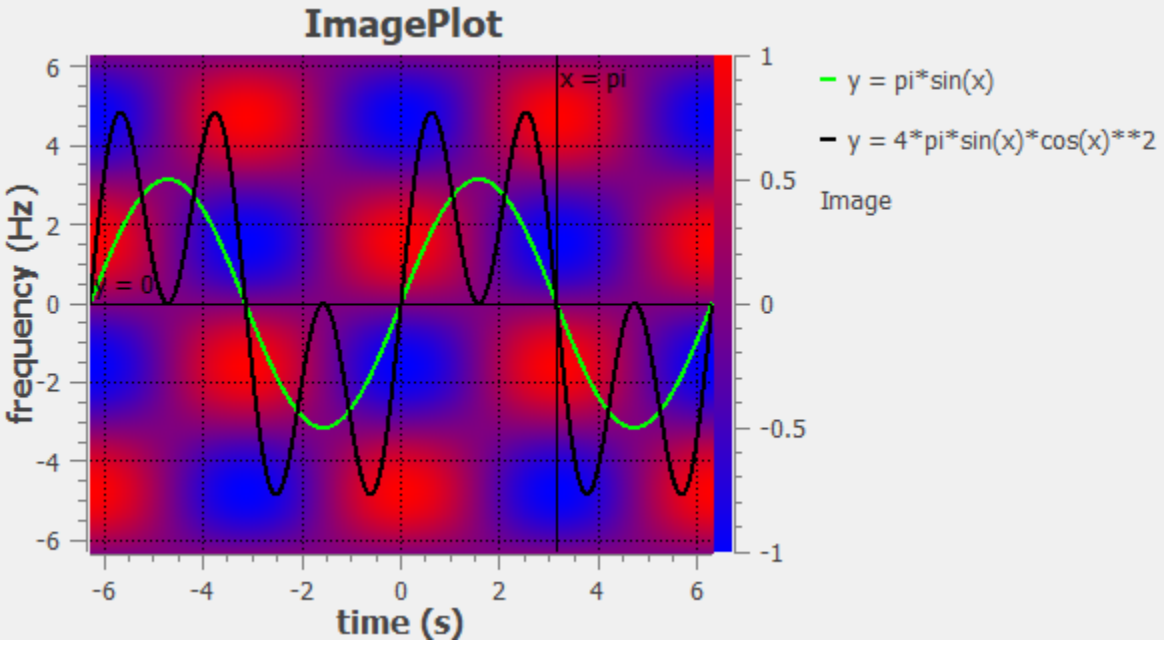
```
class EventFilterWindow(QMainWindow):
    def __init__(self, parent=None):
        super(EventFilterWindow, self).__init__(parent=parent)
        toolBar = QToolBar(self)
        toolBar.addAction(QWhatsThis.createAction(toolBar))
        self.addToolBar(toolBar)
        plot = Plot()
        self.setCentralWidget(plot)
        plot.setWhatsThis(
            "An useless plot to demonstrate how to use event filtering.\n\n"
            "You can click on the color bar, the scales or move the slider.\n"
            "All points can be moved using the mouse or the keyboard."
        )
        CanvasPicker(plot)
        scalePicker = ScalePicker(plot)
        scalePicker.clicked.connect(plot.insertCurve)


def test_eventfilter():
    """Event filter example"""
    utils.test_widget(EventFilterWindow, size=(540, 400))


if __name__ == "__main__":
    test_eventfilter()
```

4.2.11 Image plot demo




```
import numpy as np
```

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```
from qtpy.QtCore import Qt
from qtpy.QtGui import QPen, qRgb

from qwt import (
    QwtInterval,
    QwtLegend,
    QwtLegendData,
    QwtLinearColorMap,
    QwtPlot,
    QwtPlotCurve,
    QwtPlotGrid,
    QwtPlotItem,
    QwtPlotMarker,
    QwtScaleMap,
    toQImage,
)
from qwt.tests import utils


def bytescale(data, cmin=None, cmax=None, high=255, low=0):
    if (hasattr(data, "dtype") and data.dtype.char == np.uint8) or (
        hasattr(data, "typecode") and data.typecode == np.uint8
    ):
        return data
    high = high - low
    if cmin is None:
        cmin = min(np.ravel(data))
    if cmax is None:
        cmax = max(np.ravel(data))
    scale = high * 1.0 / (cmax - cmin or 1)
    bytedata = ((data * 1.0 - cmin) * scale + 0.4999).astype(np.uint8)
    return bytedata + np.asarray(low).astype(np.uint8)


def linearX(nx, ny):
    return np.repeat(np.arange(nx, typecode=np.float32)[:, np.newaxis], ny, -1)


def linearY(nx, ny):
    return np.repeat(np.arange(ny, typecode=np.float32)[np.newaxis, :], nx, 0)


def square(n, min, max):
    t = np.arange(min, max, float(max - min) / (n - 1))
    # return outer(cos(t), sin(t))
    return np.cos(t) * np.sin(t)[:, np.newaxis]


class PlotImage(QwtPlotItem):
    def __init__(self, title=""):
        QwtPlotItem.__init__(self)
        self.setTitle(title)
```

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```
        self.setItemAttribute(QwtPlotItem.Legend)
        self.xyzs = None

    def setData(self, xyzs, xRange=None, yRange=None):
        self.xyzs = xyzs
        shape = xyzs.shape
        if not xRange:
            xRange = (0, shape[0])
        if not yRange:
            yRange = (0, shape[1])

        self.xMap = QwtScaleMap(0, xyzs.shape[0], *xRange)
        self.plot().setAxisScale(QwtPlot.xBottom, *xRange)
        self.yMap = QwtScaleMap(0, xyzs.shape[1], *yRange)
        self.plot().setAxisScale(QwtPlot.yLeft, *yRange)

        self.image = toQImage(bytescale(self.xyzs)).mirrored(False, True)
        for i in range(0, 256):
            self.image.setColor(i, qRgb(i, 0, 255 - i))

    def updateLegend(self, legend, data):
        QwtPlotItem.updateLegend(self, legend, data)
        legend.find(self).setText(self.title())

    def draw(self, painter, xMap, yMap, rect):
        """Paint image zoomed to xMap, yMap

        Calculate (x1, y1, x2, y2) so that it contains at least 1 pixel,
        and copy the visible region to scale it to the canvas.
        """
        assert isinstance(self.plot(), QwtPlot)

        # calculate y1, y2
        # the scanline order (index y) is inverted with respect to the y-axis
        y1 = y2 = self.image.height()
        y1 *= self.yMap.s2() - yMap.s2()
        y1 /= self.yMap.s2() - self.yMap.s1()
        y1 = max(0, int(y1 - 0.5))
        y2 *= self.yMap.s2() - yMap.s1()
        y2 /= self.yMap.s2() - self.yMap.s1()
        y2 = min(self.image.height(), int(y2 + 0.5))
        # calculate x1, x2 -- the pixel order (index x) is normal
        x1 = x2 = self.image.width()
        x1 *= xMap.s1() - self.xMap.s1()
        x1 /= self.xMap.s2() - self.xMap.s1()
        x1 = max(0, int(x1 - 0.5))
        x2 *= xMap.s2() - self.xMap.s1()
        x2 /= self.xMap.s2() - self.xMap.s1()
        x2 = min(self.image.width(), int(x2 + 0.5))
        # copy
        image = self.image.copy(x1, y1, x2 - x1, y2 - y1)
        # zoom
```

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```
        image = image.scaled(
            int(xMap.p2() - xMap.p1() + 1), int(yMap.p1() - yMap.p2() + 1)
        )
        # draw
        painter.drawImage(int(xMap.p1()), int(yMap.p2()), image)


class ImagePlot(QwtPlot):
    def __init__(self, *args):
        QwtPlot.__init__(self, *args)
        # set plot title
        self.setTitle("ImagePlot")
        # set plot layout
        self.plotLayout().setCanvasMargin(0)
        self.plotLayout().setAlignCanvasToScales(True)
        # set legend
        legend = QwtLegend()
        legend.setDefaultItemMode(QwtLegendData.Clickable)
        self.insertLegend(legend, QwtPlot.RightLegend)
        # set axis titles
        self.setAxisTitle(QwtPlot.xBottom, "time (s)")
        self.setAxisTitle(QwtPlot.yLeft, "frequency (Hz)")

        colorMap = QwtLinearColorMap(Qt.blue, Qt.red)
        interval = QwtInterval(-1, 1)
        self.enableAxis(QwtPlot.yRight)
        self.setAxisScale(QwtPlot.yRight, -1, 1)
        self.axisWidget(QwtPlot.yRight).setColorBarEnabled(True)
        self.axisWidget(QwtPlot.yRight).setColorMap(interval, colorMap)

        # calculate 3 NumPy arrays
        x = np.arange(-2 * np.pi, 2 * np.pi, 0.01)
        y = np.pi * np.sin(x)
        z = 4 * np.pi * np.cos(x) * np.cos(x) * np.sin(x)
        # attach a curve
        QwtPlotCurve.make(
            x, y, title="y = pi*sin(x)", linecolor=Qt.green, linewidth=2, plot=self
        )
        # attach another curve
        QwtPlotCurve.make(
            x, z, title="y = 4*pi*sin(x)*cos(x)**2", linewidth=2, plot=self
        )
        # attach a grid
        grid = QwtPlotGrid()
        grid.attach(self)
        grid.setPen(QPen(Qt.black, 0, Qt.DotLine))
        # attach a horizontal marker at y = 0
        QwtPlotMarker.make(
            label="y = 0",
            linestyle=QwtPlotMarker.HLine,
            align=Qt.AlignRight | Qt.AlignTop,
            plot=self,
```

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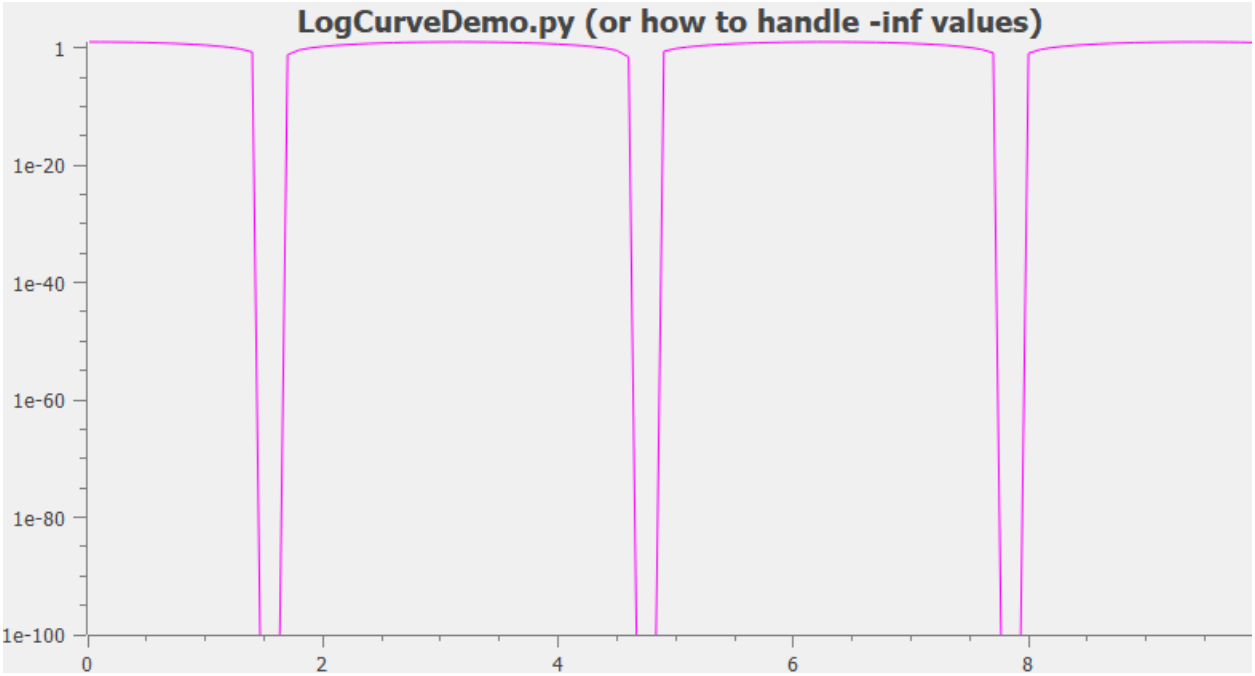
```
        )
        # attach a vertical marker at x = pi
        QwtPlotMarker.make(
            np.pi,
            0.0,
            label="x = pi",
            linestyle=QwtPlotMarker.VLine,
            align=Qt.AlignRight | Qt.AlignBottom,
            plot=self,
        )
        # attach a plot image
        plotImage = PlotImage("Image")
        plotImage.attach(self)
        plotImage.setData(
            square(512, -2 * np.pi, 2 * np.pi),
            (-2 * np.pi, 2 * np.pi),
            (-2 * np.pi, 2 * np.pi),
        )

        legend.clicked.connect(self.toggleVisibility)

        # replot
        self.replot()

    def toggleVisibility(self, plotItem, idx):
        """Toggle the visibility of a plot item"""
        plotItem.setVisible(not plotItem.isVisible())
        self.replot()


def test_image():
    """Image plot test"""
    utils.test_widget(ImagePlot, size=(600, 400))


if __name__ == "__main__":
    test_image()
```

4.2.12 Log curve plot demo




```
import numpy as np

np.seterr(all="raise")

from qtpy.QtCore import Qt

from qwt import QwtLogScaleEngine, QwtPlot, QwtPlotCurve
from qwt.tests import utils


class LogCurvePlot(QwtPlot):
    def __init__(self):
        super(LogCurvePlot, self).__init__(
            "LogCurveDemo.py (or how to handle -inf values)"
        )
        self.enableAxis(QwtPlot.xBottom)
        self.setAxisScaleEngine(QwtPlot.yLeft, QwtLogScaleEngine())
        x = np.arange(0.0, 10.0, 0.1)
        y = 10 * np.cos(x) ** 2 - 0.1
        QwtPlotCurve.make(x, y, linecolor=Qt.magenta, plot=self, antialiased=True)
        self.replot()


def test_logcurve():
    """Log curve demo"""
    utils.test_widget(LogCurvePlot, size=(800, 500))
```

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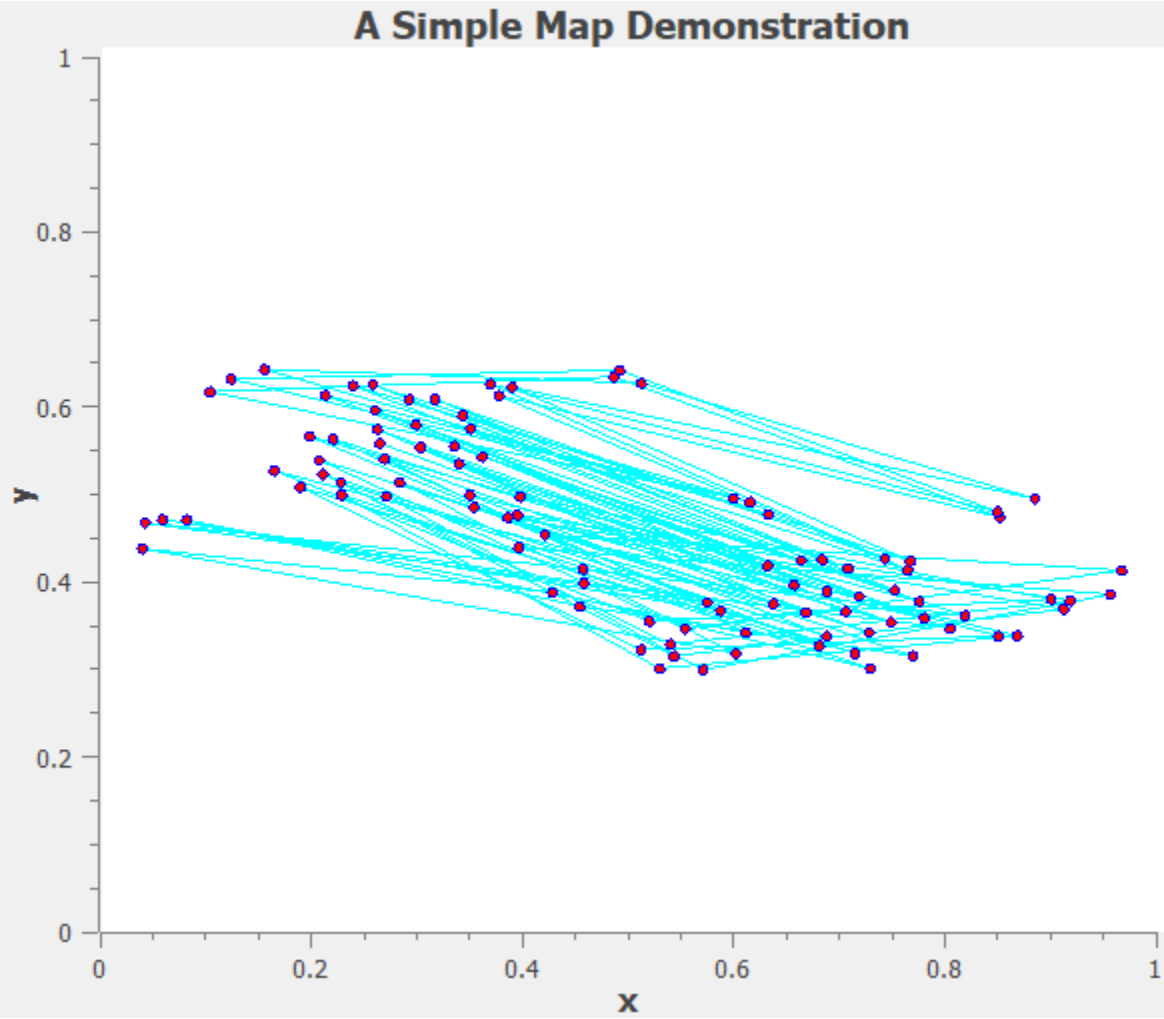
```
if __name__ == "__main__":
    test_logcurve()
```

4.2.13 Map demo




```
import random
import time

import numpy as np
from qtpy.QtCore import QSize, Qt
from qtpy.QtGui import QBrush, QPen
from qtpy.QtWidgets import QMainWindow, QToolBar

from qwt import QwtPlot, QwtPlotCurve, QwtSymbol
from qwt.tests import utils


def standard_map(x, y, kappa):
```

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```
    """provide one interate of the inital conditions (x, y)
    for the standard map with parameter kappa."""
    y_new = y - kappa * np.sin(2.0 * np.pi * x)
    x_new = x + y_new
    # bring back to [0,1.0]^2
    if (x_new > 1.0) or (x_new < 0.0):
        x_new = x_new - np.floor(x_new)
    if (y_new > 1.0) or (y_new < 0.0):
        y_new = y_new - np.floor(y_new)
    return x_new, y_new


class MapDemo(QMainWindow):
    def __init__(self, *args):
        QMainWindow.__init__(self, *args)
        self.plot = QwtPlot(self)
        self.plot.setTitle("A Simple Map Demonstration")
        self.plot.setCanvasBackground(Qt.white)
        self.plot.setAxisTitle(QwtPlot.xBottom, "x")
        self.plot.setAxisTitle(QwtPlot.yLeft, "y")
        self.plot.setAxisScale(QwtPlot.xBottom, 0.0, 1.0)
        self.plot.setAxisScale(QwtPlot.yLeft, 0.0, 1.0)
        self.setCentralWidget(self.plot)
        # Initialize map data
        self.count = self.i = 1000
        self.xs = np.zeros(self.count, float)
        self.ys = np.zeros(self.count, float)
        self.kappa = 0.2
        self.curve = QwtPlotCurve("Map")
        self.curve.attach(self.plot)
        self.curve.setSymbol(
            QwtSymbol(QwtSymbol.Ellipse, QBrush(Qt.red), QPen(Qt.blue), QSize(5, 5))
        )
        self.curve.setPen(QPen(Qt.cyan))
        toolBar = QToolBar(self)
        self.addToolBar(toolBar)
        # 1 tick = 1 ms, 10 ticks = 10 ms (Linux clock is 100 Hz)
        self.ticks = 10
        self.tid = self.startTimer(self.ticks)
        self.timer_tic = None
        self.user_tic = None
        self.system_tic = None
        self.plot.replot()

    def setTicks(self, ticks):
        self.i = self.count
        self.ticks = int(ticks)
        self.killTimer(self.tid)
        self.tid = self.startTimer(ticks)

    def moreData(self):
        if self.i == self.count:
```

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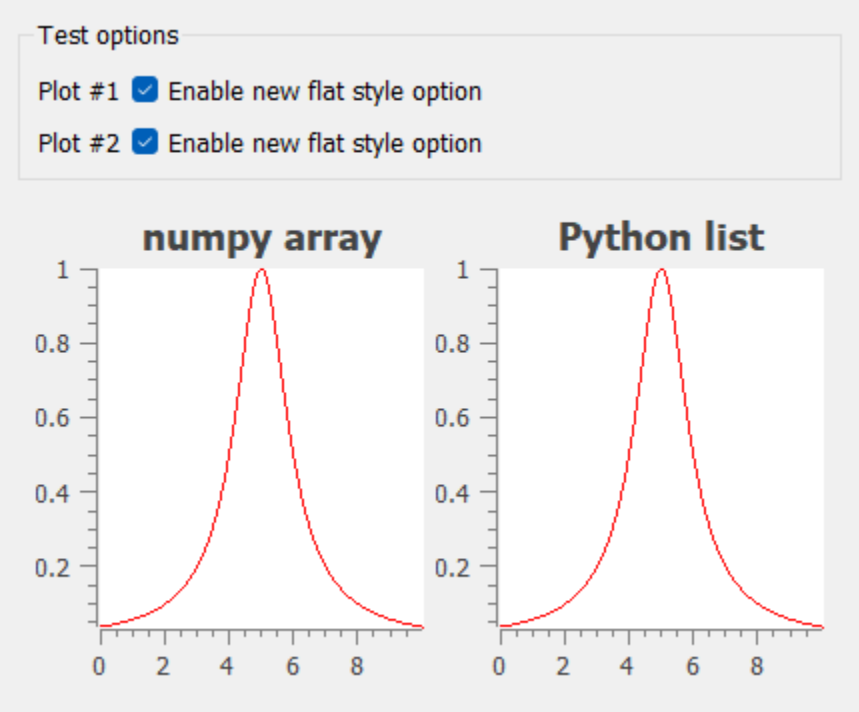
```
            self.i = 0
            self.x = random.random()
            self.y = random.random()
            self.xs[self.i] = self.x
            self.ys[self.i] = self.y
            self.i += 1
            chunks = []
            self.timer_toc = time.time()
            if self.timer_tic:
                chunks.append("wall: %s s." % (self.timer_toc - self.timer_tic))
                print(" ".join(chunks))
            self.timer_tic = self.timer_toc
        else:
            self.x, self.y = standard_map(self.x, self.y, self.kappa)
            self.xs[self.i] = self.x
            self.ys[self.i] = self.y
            self.i += 1

    def timerEvent(self, e):
        self.moreData()
        self.curve.setData(self.xs[: self.i], self.ys[: self.i])
        self.plot.replot()


def test_mapdemo():
    """Map demo"""
    utils.test_widget(MapDemo, size=(600, 600))


if __name__ == "__main__":
    test_mapdemo()
```

4.2.14 Multi demo




```
import numpy as np
from qtpy.QtCore import Qt
from qtpy.QtGui import QPen
from qtpy.QtWidgets import QGridLayout, QWidget

from qwt import QwtPlot, QwtPlotCurve
from qwt.tests import utils


def drange(start, stop, step):
    start, stop, step = float(start), float(stop), float(step)
    size = int(round((stop - start) / step))
    result = [start] * size
    for i in range(size):
        result[i] += i * step
    return result


def lorentzian(x):
    return 1.0 / (1.0 + (x - 5.0) ** 2)


class MultiDemo(QWidget):
    def __init__(self, *args):
        QWidget.__init__(self, *args)
        layout = QGridLayout(self)
        # try to create a plot for SciPy arrays
```

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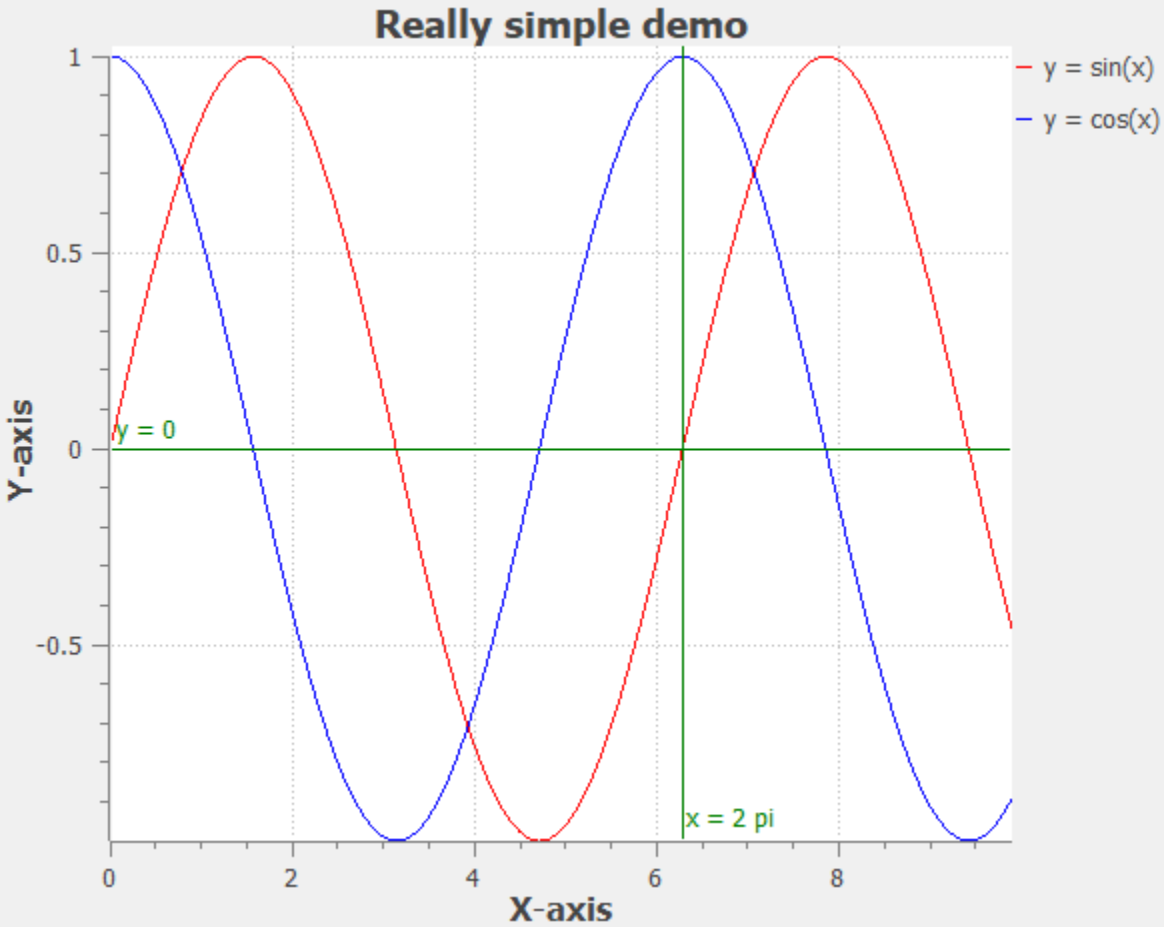
```
        # make a curve and copy the data
        numpy_curve = QwtPlotCurve("y = lorentzian(x)")
        x = np.arange(0.0, 10.0, 0.01)
        y = lorentzian(x)
        numpy_curve.setData(x, y)
        # here, we know we can plot NumPy arrays
        numpy_plot = QwtPlot(self)
        numpy_plot.setTitle("numpy array")
        numpy_plot.setCanvasBackground(Qt.white)
        numpy_plot.plotLayout().setCanvasMargin(0)
        numpy_plot.plotLayout().setAlignCanvasToScales(True)
        # insert a curve and make it red
        numpy_curve.attach(numpy_plot)
        numpy_curve.setPen(QPen(Qt.red))
        layout.addWidget(numpy_plot, 0, 0)
        numpy_plot.replot()

        # create a plot widget for lists of Python floats
        list_plot = QwtPlot(self)
        list_plot.setTitle("Python list")
        list_plot.setCanvasBackground(Qt.white)
        list_plot.plotLayout().setCanvasMargin(0)
        list_plot.plotLayout().setAlignCanvasToScales(True)
        x = drange(0.0, 10.0, 0.01)
        y = [lorentzian(item) for item in x]
        # insert a curve, make it red and copy the lists
        list_curve = QwtPlotCurve("y = lorentzian(x)")
        list_curve.attach(list_plot)
        list_curve.setPen(QPen(Qt.red))
        list_curve.setData(x, y)
        layout.addWidget(list_plot, 0, 1)
        list_plot.replot()


def test_multidemo():
    """Multiple plot demo"""
    utils.test_widget(MultiDemo, size=(400, 300))


if __name__ == "__main__":
    test_multidemo()
```

4.2.15 Really simple demo




```
import os

import numpy as np
from qtpy.QtCore import Qt, QTimer

import qwt
from qwt.tests import utils

FNAMES = ("test_simple.svg", "test_simple.pdf", "test_simple.png")


class SimplePlot(qwt.QwtPlot):
    NUM_POINTS = 100
    TEST_EXPORT = True

    def __init__(self):
        qwt.QwtPlot.__init__(self)
        self.setTitle("Really simple demo")
        self.insertLegend(qwt.QwtLegend(), qwt.QwtPlot.RightLegend)
        self.setAxisTitle(qwt.QwtPlot.xBottom, "X-axis")
```

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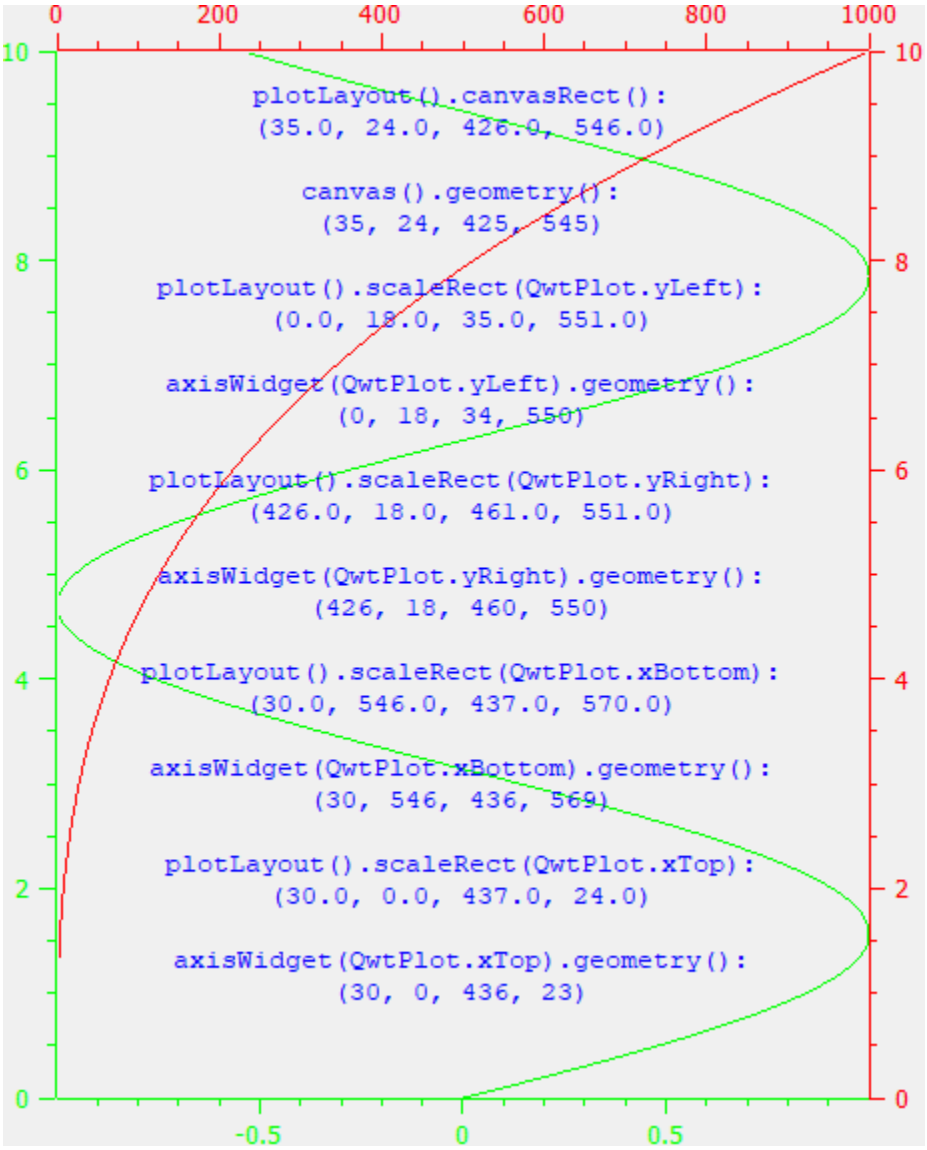
```
        self.setAxisTitle(qwt.QwtPlot.yLeft, "Y-axis")
        self.enableAxis(self.xBottom)
        self.setCanvasBackground(Qt.white)

        qwt.QwtPlotGrid.make(self, color=Qt.lightGray, width=0, style=Qt.DotLine)

        # insert a few curves
        x = np.linspace(0.0, 10.0, self.NUM_POINTS)
        qwt.QwtPlotCurve.make(x, np.sin(x), "y = sin(x)", self, linecolor="red")
        qwt.QwtPlotCurve.make(x, np.cos(x), "y = cos(x)", self, linecolor="blue")

        # insert a horizontal marker at y = 0
        qwt.QwtPlotMarker.make(
            label="y = 0",
            align=Qt.AlignRight | Qt.AlignTop,
            linestyle=qwt.QwtPlotMarker.HLine,
            color="darkGreen",
            plot=self,
        )

        # insert a vertical marker at x = 2 pi
        qwt.QwtPlotMarker.make(
            xvalue=2 * np.pi,
            label="x = 2 pi",
            align=Qt.AlignRight | Qt.AlignTop,
            linestyle=qwt.QwtPlotMarker.VLine,
            color="darkGreen",
            plot=self,
        )

        if self.TEST_EXPORT and utils.TestEnvironment().unattended:
            QTimer.singleShot(0, self.export_to_different_formats)

    def export_to_different_formats(self):
        for fname in FNAMES:
            self.exportTo(fname)


def test_simple():
    """Simple plot example"""
    utils.test_widget(SimplePlot, size=(600, 400))
    for fname in FNAMES:
        if os.path.isfile(fname):
            os.remove(fname)


if __name__ == "__main__":
    test_simple()
```

4.2.16 Vertical plot demo




```
import numpy as np
from qtpy.QtCore import Qt
from qtpy.QtGui import QColor, QPalette, QPen

from qwt import QwtPlot, QwtPlotCurve, QwtPlotMarker, QwtText
from qwt.tests import utils


class VerticalPlot(QwtPlot):
    def __init__(self, parent=None):
        super(VerticalPlot, self).__init__(parent)
        self.setWindowTitle("PythonQwt")
        self.enableAxis(self.xTop, True)
        self.enableAxis(self.yRight, True)
```

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```
        y = np.linspace(0, 10, 500)
        curve1 = QwtPlotCurve.make(np.sin(y), y, title="Test Curve 1")
        curve2 = QwtPlotCurve.make(y**3, y, title="Test Curve 2")
        curve2.setAxes(self.xTop, self.yRight)

        for item, col, xa, ya in (
            (curve1, Qt.green, self.xBottom, self.yLeft),
            (curve2, Qt.red, self.xTop, self.yRight),
        ):
            item.attach(self)
            item.setPen(QPen(col))
            for axis_id in xa, ya:
                palette = self.axisWidget(axis_id).palette()
                palette.setColor(QPalette.WindowText, QColor(col))
                palette.setColor(QPalette.Text, QColor(col))
                self.axisWidget(axis_id).setPalette(palette)
                ticks_font = self.axisFont(axis_id)
                self.setAxisFont(axis_id, ticks_font)

        self.marker = QwtPlotMarker.make(0, 5, plot=self)

    def resizeEvent(self, event):
        super(VerticalPlot, self).resizeEvent(event)
        self.show_layout_details()

    def show_layout_details(self):
        text = (
            "plotLayout().canvasRect():\n%r\n\n"
            "canvas().geometry():\n%r\n\n"
            "plotLayout().scaleRect(QwtPlot.yLeft):\n%r\n\n"
            "axisWidget(QwtPlot.yLeft).geometry():\n%r\n\n"
            "plotLayout().scaleRect(QwtPlot.yRight):\n%r\n\n"
            "axisWidget(QwtPlot.yRight).geometry():\n%r\n\n"
            "plotLayout().scaleRect(QwtPlot.xBottom):\n%r\n\n"
            "axisWidget(QwtPlot.xBottom).geometry():\n%r\n\n"
            "plotLayout().scaleRect(QwtPlot.xTop):\n%r\n\n"
            "axisWidget(QwtPlot.xTop).geometry():\n%r\n\n"
            % (
                self.plotLayout().canvasRect().getCoords(),
                self.canvas().geometry().getCoords(),
                self.plotLayout().scaleRect(QwtPlot.yLeft).getCoords(),
                self.axisWidget(QwtPlot.yLeft).geometry().getCoords(),
                self.plotLayout().scaleRect(QwtPlot.yRight).getCoords(),
                self.axisWidget(QwtPlot.yRight).geometry().getCoords(),
                self.plotLayout().scaleRect(QwtPlot.xBottom).getCoords(),
                self.axisWidget(QwtPlot.xBottom).geometry().getCoords(),
                self.plotLayout().scaleRect(QwtPlot.xTop).getCoords(),
                self.axisWidget(QwtPlot.xTop).geometry().getCoords(),
            )
        )
        self.marker.setLabel(QwtText.make(text, family="Courier New", color=Qt.blue))
```

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```
def test_vertical():
    """Vertical plot example"""
    utils.test_widget(VerticalPlot, size=(300, 650))


if __name__ == "__main__":
    test_vertical()
```

CHAPTER

FIVE

REFERENCE

Public API:

5.1 Plot widget fundamentals

5.1.1 QwtPlot

class qwt.plot.**QwtPlot**(**args*)

A 2-D plotting widget

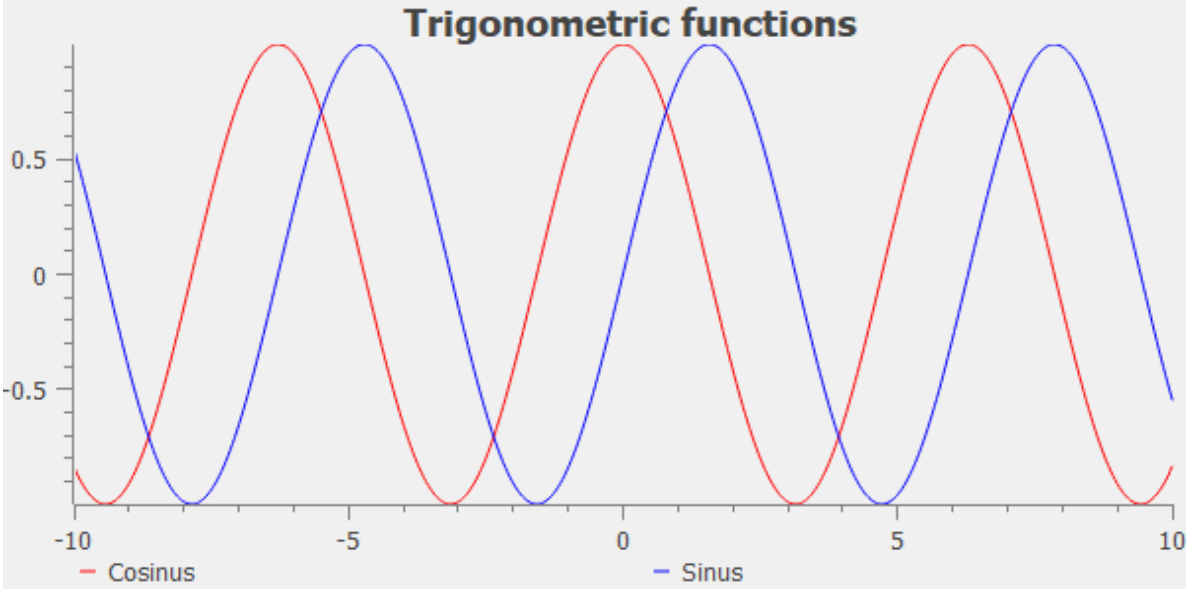
QwtPlot is a widget for plotting two-dimensional graphs. An unlimited number of plot items can be displayed on its canvas. Plot items might be curves (*qwt.plot_curve.QwtPlotCurve*), markers (*qwt.plot_marker.QwtPlotMarker*), the grid (*qwt.plot_grid.QwtPlotGrid*), or anything else derived from *QwtPlotItem*.

A plot can have up to four axes, with each plot item attached to an x- and a y axis. The scales at the axes can be explicitly set (*QwtScaleDiv*), or are calculated from the plot items, using algorithms (*QwtScaleEngine*) which can be configured separately for each axis.

The following example is a good starting point to see how to set up a plot widget:

```
from qtpy import QtWidgets as QW
import qwt
import numpy as np

app = QW.QApplication([])
x = np.linspace(-10, 10, 500)
plot = qwt.QwtPlot("Trigonometric functions")
plot.insertLegend(qwt.QwtLegend(), qwt.QwtPlot.BottomLegend)
qwt.QwtPlotCurve.make(x, np.cos(x), "Cosine", plot, linecolor="red",␣
↪antialiased=True)
qwt.QwtPlotCurve.make(x, np.sin(x), "Sine", plot, linecolor="blue",␣
↪antialiased=True)
plot.resize(600, 300)
plot.show()
```



class QwtPlot([*title=""*][, *parent=None*])

Parameters

- **title** (*str*) – Title text
- **parent** (*QWidget*) – Parent widget

itemAttached

A signal indicating, that an item has been attached/detached

Parameters

- **plotItem** – Plot item
- **on** – Attached/Detached

legendDataChanged

A signal with the attributes how to update the legend entries for a plot item.

Parameters

- **itemInfo** – Info about a plot item, build from itemToInfo()
- **data** – Attributes of the entries (usually <= 1) for the plot item.

insertItem(*item*)

Insert a plot item

Parameters

item (qwt.plot.QwtPlotItem) – PlotItem

See also

removeItem()

> **Note**
>
> This was a member of QwtPlotDict in older versions.

removeItem(*item*)

Remove a plot item

Parameters
item (qwt.plot.QwtPlotItem) – PlotItem

> **See also**
>
> *insertItem()*

> **Note**
>
> This was a member of QwtPlotDict in older versions.

detachItems(*rtti=None*)

Detach items from the dictionary

Parameters
rtti (*int or None*) – In case of *QwtPlotItem.Rtti_PlotItem* or None (default) detach all items otherwise only those items of the type rtti.

> **Note**
>
> This was a member of QwtPlotDict in older versions.

itemList(*rtti=None*)

A list of attached plot items.

Use caution when iterating these lists, as removing/detaching an item will invalidate the iterator. Instead you can place pointers to objects to be removed in a removal list, and traverse that list later.

Parameters
rtti (*int*) – In case of *QwtPlotItem.Rtti_PlotItem* detach all items otherwise only those items of the type rtti.

Returns
List of all attached plot items of a specific type. If rtti is None, return a list of all attached plot items.

> **Note**
>
> This was a member of QwtPlotDict in older versions.

setFlatStyle(*state*)

Set or reset the flatStyle option

If the flatStyle option is set, the plot will be rendered without any margin (scales, canvas, layout).

Enabling this option makes the plot look flat and compact.

The flatStyle option is set to True by default.

Parameters
state (*bool*) – True or False.

See also

flatStyle()

flatStyle()

Returns
True if the flatStyle option is set.

See also

setFlatStyle()

initAxesData()

Initialize axes

axisWidget(*axisId*)

Parameters
axisId (*int*) – Axis index

Returns
Scale widget of the specified axis, or None if axisId is invalid.

setAxisScaleEngine(*axisId*, *scaleEngine*)

Change the scale engine for an axis

Parameters

- **axisId** (*int*) – Axis index
- **scaleEngine** (qwt.scale_engine.QwtScaleEngine) – Scale engine

See also

axisScaleEngine()

axisScaleEngine(*axisId*)

Parameters
axisId (*int*) – Axis index

Returns
Scale engine for a specific axis

> **See also**
>
> *setAxisScaleEngine()*

axisAutoScale(*axisId*)

Parameters
axisId (*int*) – Axis index

Returns
True, if autoscaling is enabled

axisEnabled(*axisId*)

Parameters
axisId (*int*) – Axis index

Returns
True, if a specified axis is enabled

axisFont(*axisId*)

Parameters
axisId (*int*) – Axis index

Returns
The font of the scale labels for a specified axis

axisMaxMajor(*axisId*)

Parameters
axisId (*int*) – Axis index

Returns
The maximum number of major ticks for a specified axis

> **See also**
>
> *setAxisMaxMajor()*, *qwt.scale_engine.QwtScaleEngine.divideScale()*

axisMaxMinor(*axisId*)

Parameters
axisId (*int*) – Axis index

Returns
The maximum number of minor ticks for a specified axis

> **See also**
>
> *setAxisMaxMinor()*, *qwt.scale_engine.QwtScaleEngine.divideScale()*

axisScaleDiv(*axisId*)

Parameters
axisId (*int*) – Axis index

Returns
The scale division of a specified axis

axisScaleDiv(axisId).lowerBound(), axisScaleDiv(axisId).upperBound() are the current limits of the axis scale.

See also

qwt.scale_div.QwtScaleDiv, *setAxisScaleDiv()*, *qwt.scale_engine.QwtScaleEngine.divideScale()*

`axisScaleDraw`(*axisId*)

Parameters
axisId (*int*) – Axis index

Returns
Specified scaleDraw for axis, or NULL if axis is invalid.

`axisStepSize`(*axisId*)

Parameters
axisId (*int*) – Axis index

Returns
step size parameter value

This doesn't need to be the step size of the current scale.

See also

setAxisScale(), *qwt.scale_engine.QwtScaleEngine.divideScale()*

`axisMargin`(*axisId*)

Parameters
axisId (*int*) – Axis index

Returns
Relative margin of the axis, as a fraction of the full axis range

See also

setAxisMargin()

`axisInterval`(*axisId*)

Parameters
axisId (*int*) – Axis index

Returns
The current interval of the specified axis

This is only a convenience function for axisScaleDiv(axisId).interval()

> **See also**
>
> *qwt.scale_div.QwtScaleDiv*, *axisScaleDiv()*

axisTitle(*axisId*)

Parameters
axisId (*int*) – Axis index

Returns
Title of a specified axis

enableAxis(*axisId*, *tf=True*)

Enable or disable a specified axis

When an axis is disabled, this only means that it is not visible on the screen. Curves, markers and can be attached to disabled axes, and transformation of screen coordinates into values works as normal.

Only xBottom and yLeft are enabled by default.

Parameters

- **axisId** (*int*) – Axis index
- **tf** (*bool*) – True (enabled) or False (disabled)

invTransform(*axisId*, *pos*)

Transform the x or y coordinate of a position in the drawing region into a value.

Parameters

- **axisId** (*int*) – Axis index
- **pos** (*int*) – position

> **Warning**
>
> The position can be an x or a y coordinate, depending on the specified axis.

transform(*axisId*, *value*)

Transform a value into a coordinate in the plotting region

Parameters

- **axisId** (*int*) – Axis index
- **value** (*fload*) – Value

Returns
X or Y coordinate in the plotting region corresponding to the value.

setAxisFont(*axisId*, *font*)

Change the font of an axis

Parameters

- **axisId** (*int*) – Axis index
- **font** (*QFont*) – Font

> **Warning**
>
> This function changes the font of the tick labels, not of the axis title.

setAxisAutoScale(*axisId*, *on=True*)

Enable autoscaling for a specified axis

This member function is used to switch back to autoscaling mode after a fixed scale has been set. Autoscaling is enabled by default.

Parameters

- **axisId** (*int*) – Axis index
- **on** (*bool*) – On/Off

> **See also**
>
> *setAxisScale()*, *setAxisScaleDiv()*, *updateAxes()*

> **Note**
>
> The autoscaling flag has no effect until updateAxes() is executed (called by replot()).

setAxisScale(*axisId*, *min_*, *max_*, *stepSize=0*)

Disable autoscaling and specify a fixed scale for a selected axis.

In updateAxes() the scale engine calculates a scale division from the specified parameters, that will be assigned to the scale widget. So updates of the scale widget usually happen delayed with the next replot.

Parameters

- **axisId** (*int*) – Axis index
- **min** (*float*) – Minimum of the scale
- **max** (*float*) – Maximum of the scale
- **stepSize** (*float*) – Major step size. If <code>step == 0</code>, the step size is calculated automatically using the maxMajor setting.

> **See also**
>
> *setAxisMaxMajor()*, *setAxisAutoScale()*, *axisStepSize()*, *qwt.scale_engine.QwtScaleEngine.divideScale()*

setAxisScaleDiv(*axisId*, *scaleDiv*)

Disable autoscaling and specify a fixed scale for a selected axis.

The scale division will be stored locally only until the next call of updateAxes(). So updates of the scale widget usually happen delayed with the next replot.

Parameters

- **axisId** (*int*) – Axis index

- **scaleDiv** (qwt.scale_div.QwtScaleDiv) – Scale division

See also

setAxisScale(), *setAxisAutoScale()*

setAxisScaleDraw(*axisId*, *scaleDraw*)

Set a scale draw

Parameters

- **axisId** (*int*) – Axis index
- **scaleDraw** (qwt.scale_draw.QwtScaleDraw) – Object responsible for drawing scales.

By passing scaleDraw it is possible to extend QwtScaleDraw functionality and let it take place in QwtPlot. Please note that scaleDraw has to be created with new and will be deleted by the corresponding QwtScale member (like a child object).

See also

qwt.scale_draw.QwtScaleDraw, qwt.scale_widget.QwtScaleWigdet

Warning

The attributes of scaleDraw will be overwritten by those of the previous QwtScaleDraw.

setAxisLabelAlignment(*axisId*, *alignment*)

Change the alignment of the tick labels

Parameters

- **axisId** (*int*) – Axis index
- **alignment** (*Qt.Alignment*) – Or'd Qt.AlignmentFlags

See also

qwt.scale_draw.QwtScaleDraw.setLabelAlignment()

setAxisLabelRotation(*axisId*, *rotation*)

Rotate all tick labels

Parameters

- **axisId** (*int*) – Axis index
- **rotation** (*float*) – Angle in degrees. When changing the label rotation, the label alignment might be adjusted too.

> **See also**
>
> setLabelRotation(), *setAxisLabelAlignment()*

setAxisLabelAutoSize(*axisId*, *state*)

Set tick labels automatic size option (default: on)

Parameters

- **axisId** (*int*) – Axis index
- **state** (*bool*) – On/off

> **See also**
>
> *qwt.scale_draw.QwtScaleDraw.setLabelAutoSize()*

setAxisMaxMinor(*axisId*, *maxMinor*)

Set the maximum number of minor scale intervals for a specified axis

Parameters

- **axisId** (*int*) – Axis index
- **maxMinor** (*int*) – Maximum number of minor steps

> **See also**
>
> *axisMaxMinor()*

setAxisMaxMajor(*axisId*, *maxMajor*)

Set the maximum number of major scale intervals for a specified axis

Parameters

- **axisId** (*int*) – Axis index
- **maxMajor** (*int*) – Maximum number of major steps

> **See also**
>
> *axisMaxMajor()*

setAxisMargin(*axisId*, *margin*)

Set the relative margin of the axis, as a fraction of the full axis range

Parameters

- **axisId** (*int*) – Axis index
- **margin** (*float*) – Relative margin (float between 0 and 1)

> **See also**
>
> *axisMargin()*

setAxisTitle(*axisId*, *title*)

Change the title of a specified axis

Parameters

- **axisId** (*int*) – Axis index
- **title** (*qwt.text.QwtText or str*) – axis title

updateAxes()

Rebuild the axes scales

In case of autoscaling the boundaries of a scale are calculated from the bounding rectangles of all plot items, having the *QwtPlotItem.AutoScale* flag enabled (*QwtScaleEngine.autoScale()*). Then a scale division is calculated (*QwtScaleEngine.didvideScale()*) and assigned to scale widget.

When the scale boundaries have been assigned with *setAxisScale()* a scale division is calculated (*QwtScaleEngine.didvideScale()*) for this interval and assigned to the scale widget.

When the scale has been set explicitly by *setAxisScaleDiv()* the locally stored scale division gets assigned to the scale widget.

The scale widget indicates modifications by emitting a *QwtScaleWidget.scaleDivChanged()* signal.

updateAxes() is usually called by *replot()*.

> **See also**
>
> *setAxisAutoScale()*, *setAxisScale()*, *setAxisScaleDiv()*, *replot()*, *QwtPlotItem.boundingRect()*

setCanvas(*canvas*)

Set the drawing canvas of the plot widget.

The default canvas is a *QwtPlotCanvas*.

Parameters

canvas (*QWidget*) – Canvas Widget

> **See also**
>
> *canvas()*

setMouseTracking(*enable*)

Enable or disable mouse tracking for the plot.

The plot's drawing area is occupied by the canvas widget, so mouse move events over the plot are received by the canvas rather than the plot itself. This override propagates the mouse-tracking state to the canvas so that enabling tracking on the plot delivers mouse move events even when no mouse button is pressed (see Issue #88).

Parameters

enable (*bool*) – True to enable mouse tracking, False to disable it

event(*self*, *e: QEvent | None*) → bool

eventFilter(*self*, *a0: QObject | None*, *a1: QEvent | None*) → bool

autoRefresh()

Replots the plot if *autoReplot()* is True.

setAutoReplot(*tf=True*)

Set or reset the autoReplot option

If the autoReplot option is set, the plot will be updated implicitly by manipulating member functions. Since this may be time-consuming, it is recommended to leave this option switched off and call *replot()* explicitly if necessary.

The autoReplot option is set to false by default, which means that the user has to call *replot()* in order to make changes visible.

Parameters
tf (*bool*) – True or False. Defaults to True.

See also

autoReplot()

autoReplot()

Returns
True if the autoReplot option is set.

See also

setAutoReplot()

setTitle(*title*)

Change the plot's title

Parameters
title (*str or* qwt.text.QwtText) – New title

See also

title()

title()

Returns
Title of the plot

See also

setTitle()

titleLabel()

Returns
Title label widget.

setFooter(*text*)

Change the text the footer

Parameters
text (*str or* qwt.text.QwtText) – New text of the footer

See also

footer()

footer()

Returns
Text of the footer

See also

setFooter()

footerLabel()

Returns
Footer label widget.

setPlotLayout(*layout*)

Assign a new plot layout

Parameters
layout (qwt.plot_layout.QwtPlotLayout) – Layout

See also

plotLayout()

plotLayout()

Returns
the plot's layout

See also

setPlotLayout()

legend()

Returns
the plot's legend

> **See also**
>
> *insertLegend()*

canvas()

Returns
the plot's canvas

sizeHint()

Returns
Size hint for the plot widget

> **See also**
>
> *minimumSizeHint()*

minimumSizeHint()

Returns
Return a minimum size hint

resizeEvent(*self*, *a0: QResizeEvent | None*)

replot()

Redraw the plot

If the *autoReplot* option is not set (which is the default) or if any curves are attached to raw data, the plot has to be refreshed explicitly in order to make changes visible.

> **See also**
>
> *updateAxes()*, *setAutoReplot()*

updateLayout()

Adjust plot content to its current size.

> **See also**
>
> *resizeEvent()*

getCanvasMarginsHint(*maps*, *canvasRect*)

Calculate the canvas margins

Parameters

- **maps** (*list*) – *QwtPlot.axisCnt* maps, mapping between plot and paint device coordinates
- **canvasRect** (*QRectF*) – Bounding rectangle where to paint

Plot items might indicate, that they need some extra space at the borders of the canvas by the *QwtPlotItem.Margins* flag.

See also

updateCanvasMargins(), `getCanvasMarginHint()`

updateCanvasMargins()

Update the canvas margins

Plot items might indicate, that they need some extra space at the borders of the canvas by the *QwtPlotItem.Margins* flag.

See also

getCanvasMarginsHint(), *QwtPlotItem.getCanvasMarginHint()*

drawCanvas(*painter*)

Redraw the canvas.

Parameters
painter (*QPainter*) – Painter used for drawing

Warning

drawCanvas calls drawItems what is also used for printing. Applications that like to add individual plot items better overload drawItems()

See also

getCanvasMarginsHint(), *QwtPlotItem.getCanvasMarginHint()*

drawItems(*painter*, *canvasRect*, *maps*)

Redraw the canvas.

Parameters

- **painter** (*QPainter*) – Painter used for drawing
- **canvasRect** (*QRectF*) – Bounding rectangle where to paint
- **maps** (*list*) – *QwtPlot.axisCnt* maps, mapping between plot and paint device coordinates

Note

Usually canvasRect is *contentsRect()* of the plot canvas. Due to a bug in Qt this rectangle might be wrong for certain frame styles (f.e *QFrame.Box*) and it might be necessary to fix the margins manually using *QWidget.setContentsMargins()*

canvasMap(*axisId*)

Parameters
axisId (*int*) – Axis

Returns
Map for the axis on the canvas. With this map pixel coordinates can translated to plot coordinates and vice versa.

See also

qwt.scale_map.QwtScaleMap, *transform()*, *invTransform()*

setCanvasBackground(*brush*)

Change the background of the plotting area

Sets brush to *QPalette.Window* of all color groups of the palette of the canvas. Using *canvas().setPalette()* is a more powerful way to set these colors.

Parameters
brush (*QBrush*) – New background brush

See also

canvasBackground()

canvasBackground()

Returns
Background brush of the plotting area.

See also

setCanvasBackground()

axisValid(*axis_id*)

Parameters
axis_id (*int*) – Axis

Returns
True if the specified axis exists, otherwise False

insertLegend(*legend*, *pos=None*, *ratio=-1*)

Insert a legend

If the position legend is *QwtPlot.LeftLegend* or *QwtPlot.RightLegend* the legend will be organized in one column from top to down. Otherwise the legend items will be placed in a table with a best fit number of columns from left to right.

insertLegend() will set the plot widget as parent for the legend. The legend will be deleted in the destructor of the plot or when another legend is inserted.

Legends, that are not inserted into the layout of the plot widget need to connect to the legendDataChanged() signal. Calling updateLegend() initiates this signal for an initial update. When the application code wants to implement its own layout this also needs to be done for rendering plots to a document (see QwtPlotRenderer).

Parameters

- **legend** (*qwt.legend.QwtAbstractLegend*) – Legend

- **pos** (*QwtPlot.LegendPosition*) – The legend's position.
- **ratio** (*float*) – Ratio between legend and the bounding rectangle of title, canvas and axes

Note

For top/left position the number of columns will be limited to 1, otherwise it will be set to unlimited.

Note

The legend will be shrunk if it would need more space than the given ratio. The ratio is limited to]0.0 .. 1.0]. In case of <= 0.0 it will be reset to the default ratio. The default vertical/horizontal ratio is 0.33/0.5.

See also

legend(), *qwt.plot_layout.QwtPlotLayout.legendPosition()*, *qwt.plot_layout.QwtPlotLayout.setLegendPosition()*

updateLegend(*plotItem=None*)

If plotItem is None, emit QwtPlot.legendDataChanged for all plot item. Otherwise, emit the signal for passed plot item.

Parameters

plotItem (qwt.plot.QwtPlotItem) – Plot item

See also

QwtPlotItem.legendData(), *QwtPlot.legendDataChanged*

updateLegendItems(*plotItem*, *legendData*)

Update all plot items interested in legend attributes

Call *QwtPlotItem.updateLegend()*, when the *QwtPlotItem.LegendInterest* flag is set.

Parameters

- **plotItem** (qwt.plot.QwtPlotItem) – Plot item
- **legendData** (*list*) – Entries to be displayed for the plot item (usually 1)

See also

QwtPlotItem.LegendInterest(), *QwtPlotItem.updateLegend()*

attachItem(*plotItem*, *on*)

Attach/Detach a plot item

Parameters

- **plotItem** (qwt.plot.QwtPlotItem) – Plot item

- **on** (*bool*) – When true attach the item, otherwise detach it

print_(*printer*)

Print plot to printer

Parameters
printer (*QPaintDevice or QPrinter or QSvgGenerator*) – Printer

exportTo(*filename*, *size=(800, 600)*, *size_mm=None*, *resolution=85*, *format_=None*)

Export plot to PDF or image file (SVG, PNG, ...)

Parameters

- **filename** (*str*) – Filename
- **size** (*tuple*) – (width, height) size in pixels
- **size_mm** (*tuple*) – (width, height) size in millimeters
- **resolution** (*int*) – Resolution in dots per Inch (dpi)
- **format** (*str*) – File format (PDF, SVG, PNG, ...)

5.1.2 QwtPlotItem

class qwt.plot.**QwtPlotItem**(*title=None*, *icon=None*)

Base class for items on the plot canvas

A plot item is "something", that can be painted on the plot canvas, or only affects the scales of the plot widget. They can be categorized as:

- Representator

  A "Representator" is an item that represents some sort of data on the plot canvas. The different representator classes are organized according to the characteristics of the data:

  - *qwt.plot_marker.QwtPlotMarker*: Represents a point or a horizontal/vertical coordinate
  - *qwt.plot_curve.QwtPlotCurve*: Represents a series of points

- Decorators

  A "Decorator" is an item, that displays additional information, that is not related to any data:

  - *qwt.plot_grid.QwtPlotGrid*

Depending on the *QwtPlotItem.ItemAttribute* flags, an item is included into autoscaling or has an entry on the legend.

Before misusing the existing item classes it might be better to implement a new type of plot item (don't implement a watermark as spectrogram). Deriving a new type of *QwtPlotItem* primarily means to implement the *YourPlotItem.draw()* method.

See also

The cpuplot example shows the implementation of additional plot items.

class QwtPlotItem([*title=None*])

Constructor

Parameters
title (*qwt.text.QwtText or str*) – Title of the item

attach(*plot*)

Attach the item to a plot.

This method will attach a *QwtPlotItem* to the *QwtPlot* argument. It will first detach the *QwtPlotItem* from any plot from a previous call to attach (if necessary). If a None argument is passed, it will detach from any *QwtPlot* it was attached to.

Parameters
plot (qwt.plot.QwtPlot) – Plot widget

See also

detach()

detach()

Detach the item from a plot.

This method detaches a *QwtPlotItem* from any *QwtPlot* it has been associated with.

See also

attach()

rtti()

Return rtti for the specific class represented. *QwtPlotItem* is simply a virtual interface class, and base classes will implement this method with specific rtti values so a user can differentiate them.

Returns
rtti value

plot()

Returns
attached plot

z()

Plot items are painted in increasing z-order.

Returns
item z order

See also

setZ(), QwtPlotDict.itemList()

setZ(*z*)

Set the z value

Plot items are painted in increasing z-order.

Parameters
z (*float*) – Z-value

See also

z(), QwtPlotDict.itemList()

setTitle(*title*)

Set a new title

Parameters
title (*qwt.text.QwtText or str*) – Title

See also

title()

title()

Returns
Title of the item

See also

setTitle()

setItemAttribute(*attribute*, *on=True*)

Toggle an item attribute

Parameters

- **attribute** (*int*) – Attribute type
- **on** (*bool*) – True/False

See also

testItemAttribute()

testItemAttribute(*attribute*)

Test an item attribute

Parameters
attribute (*int*) – Attribute type

Returns
True/False

See also

setItemAttribute()

setItemInterest(*interest*, *on=True*)

Toggle an item interest

Parameters

- **attribute** (*int*) – Interest type
- **on** (*bool*) – True/False

See also

testItemInterest()

testItemInterest(*interest*)

Test an item interest

Parameters
attribute (*int*) – Interest type

Returns
True/False

See also

setItemInterest()

setRenderHint(*hint*, *on=True*)

Toggle a render hint

Parameters

- **hint** (*int*) – Render hint
- **on** (*bool*) – True/False

See also

testRenderHint()

testRenderHint(*hint*)

Test a render hint

Parameters
attribute (*int*) – Render hint

Returns
True/False

See also

setRenderHint()

setLegendIconSize(*size*)

Set the size of the legend icon

The default setting is 8x8 pixels

Parameters
size (*QSize*) – Size

> **See also**
> *legendIconSize()*, *legendIcon()*

legendIconSize()

Returns
Legend icon size

> **See also**
> *setLegendIconSize()*, *legendIcon()*

legendIcon(*index*, *size*)

Parameters

- **index** (*int*) – Index of the legend entry (usually there is only one)
- **size** (*QSizeF*) – Icon size

Returns
Icon representing the item on the legend

The default implementation returns an invalid icon

> **See also**
> *setLegendIconSize()*, *legendData()*

show()
Show the item

hide()
Hide the item

setVisible(*on*)
Show/Hide the item

Parameters
on (*bool*) – Show if True, otherwise hide

> **See also**
> *isVisible()*, *show()*, *hide()*

isVisible()

Returns
True if visible

> **See also**
>
> *setVisible()*, *show()*, *hide()*

`itemChanged`()

Update the legend and call *QwtPlot.autoRefresh()* for the parent plot.

> **See also**
>
> QwtPlot.legendChanged(), *QwtPlot.autoRefresh()*

`legendChanged`()

Update the legend of the parent plot.

> **See also**
>
> *QwtPlot.updateLegend()*, *itemChanged()*

`setAxes`(*xAxis*, *yAxis*)

Set X and Y axis

The item will painted according to the coordinates of its Axes.

Parameters

- **xAxis** (*int*) – X Axis (*QwtPlot.xBottom* or *QwtPlot.xTop*)
- **yAxis** (*int*) – Y Axis (*QwtPlot.yLeft* or *QwtPlot.yRight*)

> **See also**
>
> *setXAxis()*, *setYAxis()*, *xAxis()*, *yAxis()*

`setAxis`(*xAxis*, *yAxis*)

Set X and Y axis

> **Warning**
>
> *setAxis* has been removed in Qwt6: please use *setAxes()* instead

`setXAxis`(*axis*)

Set the X axis

The item will painted according to the coordinates its Axes.

Parameters

axis (*int*) – X Axis (*QwtPlot.xBottom* or *QwtPlot.xTop*)

> **See also**
>
> *setAxes()*, *setYAxis()*, *xAxis()*, *yAxis()*

setYAxis(*axis*)

Set the Y axis

The item will painted according to the coordinates its Axes.

Parameters
axis (*int*) – Y Axis (*QwtPlot.yLeft* or *QwtPlot.yRight*)

> **See also**
>
> *setAxes()*, *setXAxis()*, *xAxis()*, *yAxis()*

xAxis()

Returns
xAxis

yAxis()

Returns
yAxis

boundingRect()

Returns
An invalid bounding rect: QRectF(1.0, 1.0, -2.0, -2.0)

> **Note**
>
> A width or height < 0.0 is ignored by the autoscaler

getCanvasMarginHint(*xMap*, *yMap*, *canvasRect*)

Calculate a hint for the canvas margin

When the QwtPlotItem::Margins flag is enabled the plot item indicates, that it needs some margins at the borders of the canvas. This is f.e. used by bar charts to reserve space for displaying the bars.

The margins are in target device coordinates (pixels on screen)

Parameters

- **xMap** (*qwt.scale_map.QwtScaleMap*) – Maps x-values into pixel coordinates.
- **yMap** (*qwt.scale_map.QwtScaleMap*) – Maps y-values into pixel coordinates.
- **canvasRect** (*QRectF*) – Contents rectangle of the canvas in painter coordinates

> **See also**
>
> *QwtPlot.getCanvasMarginsHint()*, *QwtPlot.updateCanvasMargins()*,

legendData()

Return all information, that is needed to represent the item on the legend

QwtLegendData is basically a list of QVariants that makes it possible to overload and reimplement legendData() to return almost any type of information, that is understood by the receiver that acts as the legend.

The default implementation returns one entry with the title() of the item and the legendIcon().

Returns
Data, that is needed to represent the item on the legend

See also

title(), *legendIcon()*, *qwt.legend.QwtLegend*

updateLegend(*item*, *data*)

Update the item to changes of the legend info

Plot items that want to display a legend (not those, that want to be displayed on a legend !) will have to implement updateLegend().

updateLegend() is only called when the LegendInterest interest is enabled. The default implementation does nothing.

Parameters

- **item** (qwt.plot.QwtPlotItem) – Plot item to be displayed on a legend
- **data** (*list*) – Attributes how to display item on the legend

Note

Plot items, that want to be displayed on a legend need to enable the *QwtPlotItem.Legend* flag and to implement legendData() and legendIcon()

scaleRect(*xMap*, *yMap*)

Calculate the bounding scale rectangle of 2 maps

Parameters

- **xMap** (qwt.scale_map.QwtScaleMap) – Maps x-values into pixel coordinates.
- **yMap** (qwt.scale_map.QwtScaleMap) – Maps y-values into pixel coordinates.

Returns
Bounding scale rect of the scale maps, not normalized

paintRect(*xMap*, *yMap*)

Calculate the bounding paint rectangle of 2 maps

Parameters

- **xMap** (qwt.scale_map.QwtScaleMap) – Maps x-values into pixel coordinates.
- **yMap** (qwt.scale_map.QwtScaleMap) – Maps y-values into pixel coordinates.

Returns
Bounding paint rectangle of the scale maps, not normalized

5.1.3 QwtPlotCanvas

class qwt.plot_canvas.**QwtPlotCanvas**(*plot=None*)

Canvas of a QwtPlot.

Canvas is the widget where all plot items are displayed

> **See also**
>
> *qwt.plot.QwtPlot.setCanvas()*

Paint attributes:

- *QwtPlotCanvas.BackingStore*:

  Paint double buffered reusing the content of the pixmap buffer when possible.

  Using a backing store might improve the performance significantly, when working with widget overlays (like rubber bands). Disabling the cache might improve the performance for incremental paints (using *qwt.plot_directpainter.QwtPlotDirectPainter*).

- *QwtPlotCanvas.Opaque*:

  Try to fill the complete contents rectangle of the plot canvas

  When using styled backgrounds Qt assumes, that the canvas doesn't fill its area completely (f.e because of rounded borders) and fills the area below the canvas. When this is done with gradients it might result in a serious performance bottleneck - depending on the size.

  When the Opaque attribute is enabled the canvas tries to identify the gaps with some heuristics and to fill those only.

  > **Warning**
  >
  > Will not work for semitransparent backgrounds

- *QwtPlotCanvas.HackStyledBackground*:

  Try to improve painting of styled backgrounds

  QwtPlotCanvas supports the box model attributes for customizing the layout with style sheets. Unfortunately the design of Qt style sheets has no concept how to handle backgrounds with rounded corners - beside of padding.

  When HackStyledBackground is enabled the plot canvas tries to separate the background from the background border by reverse engineering to paint the background before and the border after the plot items. In this order the border gets perfectly antialiased and you can avoid some pixel artifacts in the corners.

- *QwtPlotCanvas.ImmediatePaint*:

  When ImmediatePaint is set replot() calls repaint() instead of update().

  > **See also**
  >
  > *replot()*, QWidget.repaint(), QWidget.update()

Focus indicators:

- *QwtPlotCanvas.NoFocusIndicator*:

  Don't paint a focus indicator

- *QwtPlotCanvas.CanvasFocusIndicator*:

  The focus is related to the complete canvas. Paint the focus indicator using paintFocus()

- *QwtPlotCanvas.ItemFocusIndicator*:

  The focus is related to an item (curve, point, ...) on the canvas. It is up to the application to display a focus indication using f.e. highlighting.

class QwtPlotCanvas([*plot=None*])

Constructor

Parameters
plot (qwt.plot.QwtPlot) – Parent plot widget

See also

qwt.plot.QwtPlot.setCanvas()

plot()

Returns
Parent plot widget

setPaintAttribute(*attribute*, *on=True*)

Changing the paint attributes

Paint attributes:

- *QwtPlotCanvas.BackingStore*
- *QwtPlotCanvas.Opaque*
- *QwtPlotCanvas.HackStyledBackground*
- *QwtPlotCanvas.ImmediatePaint*

Parameters

- **attribute** (*int*) – Paint attribute
- **on** (*bool*) – On/Off

See also

testPaintAttribute(), *backingStore()*

testPaintAttribute(*attribute*)

Test whether a paint attribute is enabled

Parameters
attribute (*int*) – Paint attribute

Returns
True, when attribute is enabled

> **See also**
>
> *setPaintAttribute()*

backingStore()

Returns
Backing store, might be None

invalidateBackingStore()

Invalidate the internal backing store

setFocusIndicator(*focusIndicator*)

Set the focus indicator

Focus indicators:

- *QwtPlotCanvas.NoFocusIndicator*
- *QwtPlotCanvas.CanvasFocusIndicator*
- *QwtPlotCanvas.ItemFocusIndicator*

Parameters
focusIndicator (*int*) – Focus indicator

> **See also**
>
> *focusIndicator()*

focusIndicator()

Returns
Focus indicator

> **See also**
>
> *setFocusIndicator()*

setBorderRadius(*radius*)

Set the radius for the corners of the border frame

Parameters
radius (*float*) – Radius of a rounded corner

> **See also**
>
> *borderRadius()*

borderRadius()

Returns
Radius for the corners of the border frame

> **See also**
>
> *setBorderRadius()*

event(*self*, *e: QEvent | None*) → bool

paintEvent(*self*, *a0: QPaintEvent | None*)

drawBorder(*painter*)

Draw the border of the plot canvas

Parameters
painter (*QPainter*) – Painter

> **See also**
>
> *setBorderRadius()*

resizeEvent(*self*, *a0: QResizeEvent | None*)

drawFocusIndicator(*painter*)

Draw the focus indication

Parameters
painter (*QPainter*) – Painter

replot()

Invalidate the paint cache and repaint the canvas

updateStyleSheetInfo()

Update the cached information about the current style sheet

borderPath(*rect*)

Calculate the painter path for a styled or rounded border

When the canvas has no styled background or rounded borders the painter path is empty.

Parameters
rect (*QRect*) – Bounding rectangle of the canvas

Returns
Painter path, that can be used for clipping

5.2 Plot items

5.2.1 QwtPlotGrid

class qwt.plot_grid.**QwtPlotGrid**(*title='Grid'*)

A class which draws a coordinate grid

The *QwtPlotGrid* class can be used to draw a coordinate grid. A coordinate grid consists of major and minor vertical and horizontal grid lines. The locations of the grid lines are determined by the X and Y scale divisions which can be assigned with *setXDiv()* and *setYDiv()*. The *draw()* member draws the grid within a bounding rectangle.

classmethod make(*plot=None*, *z=None*, *enablemajor=None*, *enableminor=None*, *color=None*, *width=None*, *style=None*, *mincolor=None*, *minwidth=None*, *minstyle=None*)

Create and setup a new *QwtPlotGrid* object (convenience function).

Parameters

- **plot** (*qwt.plot.QwtPlot or None*) – Plot to attach the curve to
- **z** (*float or None*) – Z-value
- **enablemajor** (*bool or None*) – Tuple of two boolean values (x, y) for enabling major grid lines
- **enableminor** (*bool or None*) – Tuple of two boolean values (x, y) for enabling minor grid lines
- **color** (*QColor or str or None*) – Pen color for both major and minor grid lines (default: Qt.gray)
- **width** (*float or None*) – Pen width for both major and minor grid lines (default: 1.0)
- **style** (*Qt.PenStyle or None*) – Pen style for both major and minor grid lines (default: Qt.DotLine)
- **mincolor** (*QColor or str or None*) – Pen color for minor grid lines only (default: Qt.gray)
- **minwidth** (*float or None*) – Pen width for minor grid lines only (default: 1.0)
- **minstyle** (*Qt.PenStyle or None*) – Pen style for minor grid lines only (default: Qt.DotLine)

See also

setMinorPen(), *setMajorPen()*

rtti()

Returns

Return *QwtPlotItem.Rtti_PlotGrid*

enableX(*on*)

Enable or disable vertical grid lines

Parameters

on (*bool*) – Enable (true) or disable

See also

enableXMin()

enableY(*on*)

Enable or disable horizontal grid lines

Parameters

on (*bool*) – Enable (true) or disable

> **See also**
>
> *enableYMin()*

enableXMin(*on*)

Enable or disable minor vertical grid lines.

Parameters
on (*bool*) – Enable (true) or disable

> **See also**
>
> *enableX()*

enableYMin(*on*)

Enable or disable minor horizontal grid lines.

Parameters
on (*bool*) – Enable (true) or disable

> **See also**
>
> *enableY()*

setXDiv(*scaleDiv*)

Assign an x axis scale division

Parameters
scaleDiv (qwt.scale_div.QwtScaleDiv) – Scale division

setYDiv(*scaleDiv*)

Assign an y axis scale division

Parameters
scaleDiv (qwt.scale_div.QwtScaleDiv) – Scale division

setPen(**args*)

Build and/or assign a pen for both major and minor grid lines

setPen(*color*, *width*, *style*)

Build and assign a pen for both major and minor grid lines

In Qt5 the default pen width is 1.0 (0.0 in Qt4) what makes it non cosmetic (see *QPen.isCosmetic()*). This method signature has been introduced to hide this incompatibility.

Parameters
- **color** (*QColor*) – Pen color
- **width** (*float*) – Pen width
- **style** (*Qt.PenStyle*) – Pen style

setPen(*pen*)

Assign a pen for both major and minor grid lines

Parameters
pen (*QPen*) – New pen

> **See also**
>
> pen(), brush()

setMajorPen(**args*)

Build and/or assign a pen for both major grid lines

setMajorPen(*color*, *width*, *style*)

Build and assign a pen for both major grid lines

In Qt5 the default pen width is 1.0 (0.0 in Qt4) what makes it non cosmetic (see *QPen.isCosmetic()*). This method signature has been introduced to hide this incompatibility.

Parameters

- **color** (*QColor*) – Pen color
- **width** (*float*) – Pen width
- **style** (*Qt.PenStyle*) – Pen style

setMajorPen(*pen*)

Assign a pen for the major grid lines

Parameters

pen (*QPen*) – New pen

> **See also**
>
> *majorPen()*, *setMinorPen()*, *setPen()*, pen(), brush()

setMinorPen(**args*)

Build and/or assign a pen for both minor grid lines

setMinorPen(*color*, *width*, *style*)

Build and assign a pen for both minor grid lines

In Qt5 the default pen width is 1.0 (0.0 in Qt4) what makes it non cosmetic (see *QPen.isCosmetic()*). This method signature has been introduced to hide this incompatibility.

Parameters

- **color** (*QColor*) – Pen color
- **width** (*float*) – Pen width
- **style** (*Qt.PenStyle*) – Pen style

setMinorPen(*pen*)

Assign a pen for the minor grid lines

Parameters

pen (*QPen*) – New pen

> **See also**
>
> *minorPen()*, *setMajorPen()*, *setPen()*, pen(), brush()

draw(*painter*, *xMap*, *yMap*, *canvasRect*)

Draw the grid

The grid is drawn into the bounding rectangle such that grid lines begin and end at the rectangle's borders. The X and Y maps are used to map the scale divisions into the drawing region screen.

Parameters

- **painter** (*QPainter*) – Painter
- **xMap** (qwt.scale_map.QwtScaleMap) – X axis map
- **yMap** (qwt.scale_map.QwtScaleMap) – Y axis
- **canvasRect** (*QRectF*) – Contents rectangle of the plot canvas

majorPen()

Returns
the pen for the major grid lines

See also

setMajorPen(), *setMinorPen()*, *setPen()*

minorPen()

Returns
the pen for the minor grid lines

See also

setMinorPen(), *setMajorPen()*, *setPen()*

xEnabled()

Returns
True if vertical grid lines are enabled

See also

enableX()

yEnabled()

Returns
True if horizontal grid lines are enabled

See also

enableY()

xMinEnabled()

Returns
True if minor vertical grid lines are enabled

> **See also**
>
> *enableXMin()*

yMinEnabled()

Returns
True if minor horizontal grid lines are enabled

> **See also**
>
> *enableYMin()*

xScaleDiv()

Returns
the scale division of the x axis

yScaleDiv()

Returns
the scale division of the y axis

updateScaleDiv(*xScaleDiv*, *yScaleDiv*)

Update the grid to changes of the axes scale division

Parameters

- **xMap** (qwt.scale_map.QwtScaleMap) – Scale division of the x-axis
- **yMap** (qwt.scale_map.QwtScaleMap) – Scale division of the y-axis

> **See also**
>
> updateAxes()

5.2.2 QwtPlotCurve

class qwt.plot_curve.**QwtPlotCurve**(*title=None*)

A plot item, that represents a series of points

A curve is the representation of a series of points in the x-y plane. It supports different display styles and symbols.

> **See also**
>
> *qwt.symbol.QwtSymbol()*, *qwt.scale_map.QwtScaleMap()*

Curve styles:

- *QwtPlotCurve.NoCurve*:

  Don't draw a curve. Note: This doesn't affect the symbols.

- *QwtPlotCurve.Lines*:

  Connect the points with straight lines.

- *QwtPlotCurve.Sticks*:

  Draw vertical or horizontal sticks (depending on the orientation()) from a baseline which is defined by setBaseline().

- *QwtPlotCurve.Steps*:

  Connect the points with a step function. The step function is drawn from the left to the right or vice versa, depending on the QwtPlotCurve::Inverted attribute.

- *QwtPlotCurve.Dots*:

  Draw dots at the locations of the data points. Note: This is different from a dotted line (see setPen()), and faster as a curve in QwtPlotCurve::NoStyle style and a symbol painting a point.

- *QwtPlotCurve.UserCurve*:

  Styles >= QwtPlotCurve.UserCurve are reserved for derived classes of QwtPlotCurve that overload drawCurve() with additional application specific curve types.

Curve attributes:

- *QwtPlotCurve.Inverted*:

  For *QwtPlotCurve.Steps* only. Draws a step function from the right to the left.

Legend attributes:

- *QwtPlotCurve.LegendNoAttribute*:

  QwtPlotCurve tries to find a color representing the curve and paints a rectangle with it.

- *QwtPlotCurve.LegendShowLine*:

  If the style() is not *QwtPlotCurve.NoCurve* a line is painted with the curve pen().

- *QwtPlotCurve.LegendShowSymbol*:

  If the curve has a valid symbol it is painted.

- *QwtPlotCurve.LegendShowBrush*:

  If the curve has a brush a rectangle filled with the curve brush() is painted.

class QwtPlotCurve([*title=None*])

Constructor

Parameters
title (*qwt.text.QwtText or str or None*) – Curve title

classmethod make(*xdata=None*, *ydata=None*, *title=None*, *plot=None*, *z=None*, *x_axis=None*, *y_axis=None*, *style=None*, *symbol=None*, *linecolor=None*, *linewidth=None*, *linestyle=None*, *antialiased=False*, *size=None*, *finite=None*)

Create and setup a new *QwtPlotCurve* object (convenience function).

Parameters

- **xdata** – List/array of x values
- **ydata** – List/array of y values
- **title** (*qwt.text.QwtText or str or None*) – Curve title
- **plot** (*qwt.plot.QwtPlot or None*) – Plot to attach the curve to

- **z** (*float or None*) – Z-value
- **x_axis** (*int or None*) – curve X-axis (default: QwtPlot.yLeft)
- **y_axis** (*int or None*) – curve Y-axis (default: QwtPlot.xBottom)
- **style** (*int or None*) – curve style (*QwtPlotCurve.NoCurve*, *QwtPlotCurve.Lines*, *QwtPlotCurve.Sticks*, *QwtPlotCurve.Steps*, *QwtPlotCurve.Dots*, *QwtPlotCurve.UserCurve*)
- **symbol** (*qwt.symbol.QwtSymbol or None*) – curve symbol
- **linecolor** (*QColor or str or None*) – curve line color
- **linewidth** (*float or None*) – curve line width
- **linestyle** (*Qt.PenStyle or None*) – curve pen style
- **antialiased** (*bool*) – if True, enable antialiasing rendering
- **size** (*int or None*) – size of xData and yData
- **finite** (*bool*) – if True, keep only finite array elements (remove all infinity and not a number values), otherwise do not filter array elements

See also

setData(), *setPen()*, attach()

init()

Initialize internal members

rtti()

Returns
QwtPlotItem.Rtti_PlotCurve

setLegendAttribute(*attribute*, *on=True*)

Specify an attribute how to draw the legend icon

Legend attributes:

- *QwtPlotCurve.LegendNoAttribute*
- *QwtPlotCurve.LegendShowLine*
- *QwtPlotCurve.LegendShowSymbol*
- *QwtPlotCurve.LegendShowBrush*

Parameters

- **attribute** (*int*) – Legend attribute
- **on** (*bool*) – On/Off

See also

testLegendAttribute(), *legendIcon()*

testLegendAttribute(*attribute*)

Parameters
attribute (*int*) – Legend attribute

Returns
True, when attribute is enabled

See also

setLegendAttribute()

setStyle(*style*)

Set the curve's drawing style

Valid curve styles:

- *QwtPlotCurve.NoCurve*
- *QwtPlotCurve.Lines*
- *QwtPlotCurve.Sticks*
- *QwtPlotCurve.Steps*
- *QwtPlotCurve.Dots*
- *QwtPlotCurve.UserCurve*

Parameters
style (*int*) – Curve style

See also

style()

style()

Returns
Style of the curve

See also

setStyle()

setSymbol(*symbol*)

Assign a symbol

The curve will take the ownership of the symbol, hence the previously set symbol will be delete by setting a new one. If symbol is None no symbol will be drawn.

Parameters
symbol (qwt.symbol.QwtSymbol) – Symbol

See also

symbol()

symbol()

Returns
Current symbol or None, when no symbol has been assigned

See also

setSymbol()

setPen(**args*)

Build and/or assign a pen, depending on the arguments.

setPen(*color*, *width*, *style*)

Build and assign a pen

In Qt5 the default pen width is 1.0 (0.0 in Qt4) what makes it non cosmetic (see *QPen.isCosmetic()*). This method signature has been introduced to hide this incompatibility.

Parameters
- **color** (*QColor*) – Pen color
- **width** (*float*) – Pen width
- **style** (*Qt.PenStyle*) – Pen style

setPen(*pen*)

Assign a pen

Parameters
pen (*QPen*) – New pen

See also

pen(), *brush()*

pen()

Returns
Pen used to draw the lines

See also

setPen(), *brush()*

setBrush(*brush*)

Assign a brush.

In case of *brush.style() != QBrush.NoBrush* and *style() != QwtPlotCurve.Sticks* the area between the curve and the baseline will be filled.

In case *not brush.color().isValid()* the area will be filled by *pen.color()*. The fill algorithm simply connects the first and the last curve point to the baseline. So the curve data has to be sorted (ascending or descending).

Parameters
brush (*QBrush or QColor*) – New brush

See also

brush(), *setBaseline()*, *baseline()*

brush()

Returns
Brush used to fill the area between lines and the baseline

See also

setBrush(), *setBaseline()*, *baseline()*

directPaint(*from_*, *to*)

When observing a measurement while it is running, new points have to be added to an existing seriesItem. This method can be used to display them avoiding a complete redraw of the canvas.

Setting *plot().canvas().setAttribute(Qt.WA_PaintOutsidePaintEvent, True)* will result in faster painting, if the paint engine of the canvas widget supports this feature.

Parameters

- **from** (*int*) – Index of the first point to be painted
- **to** (*int*) – Index of the last point to be painted

See also

drawSeries()

drawSeries(*painter*, *xMap*, *yMap*, *canvasRect*, *from_*, *to*)

Draw an interval of the curve

Parameters

- **painter** (*QPainter*) – Painter
- **xMap** (qwt.scale_map.QwtScaleMap) – Maps x-values into pixel coordinates.
- **yMap** (qwt.scale_map.QwtScaleMap) – Maps y-values into pixel coordinates.
- **canvasRect** (*QRectF*) – Contents rectangle of the canvas
- **from** (*int*) – Index of the first point to be painted
- **to** (*int*) – Index of the last point to be painted. If to < 0 the curve will be painted to its last point.

See also

drawCurve(), *drawSymbols()*

drawCurve(*painter*, *style*, *xMap*, *yMap*, *canvasRect*, *from_*, *to*)

Draw the line part (without symbols) of a curve interval.

Parameters

- **painter** (*QPainter*) – Painter
- **style** (*int*) – curve style, see *QwtPlotCurve.CurveStyle*
- **xMap** (qwt.scale_map.QwtScaleMap) – Maps x-values into pixel coordinates.
- **yMap** (qwt.scale_map.QwtScaleMap) – Maps y-values into pixel coordinates.
- **canvasRect** (*QRectF*) – Contents rectangle of the canvas
- **from** (*int*) – Index of the first point to be painted
- **to** (*int*) – Index of the last point to be painted. If to < 0 the curve will be painted to its last point.

See also

draw(), *drawDots()*, *drawLines()*, *drawSteps()*, *drawSticks()*

drawLines(*painter*, *xMap*, *yMap*, *canvasRect*, *from_*, *to*)

Draw lines

Parameters

- **painter** (*QPainter*) – Painter
- **xMap** (qwt.scale_map.QwtScaleMap) – Maps x-values into pixel coordinates.
- **yMap** (qwt.scale_map.QwtScaleMap) – Maps y-values into pixel coordinates.
- **canvasRect** (*QRectF*) – Contents rectangle of the canvas
- **from** (*int*) – Index of the first point to be painted
- **to** (*int*) – Index of the last point to be painted. If to < 0 the curve will be painted to its last point.

See also

draw(), *drawDots()*, *drawSteps()*, *drawSticks()*

drawSticks(*painter*, *xMap*, *yMap*, *canvasRect*, *from_*, *to*)

Draw sticks

Parameters

- **painter** (*QPainter*) – Painter
- **xMap** (qwt.scale_map.QwtScaleMap) – Maps x-values into pixel coordinates.
- **yMap** (qwt.scale_map.QwtScaleMap) – Maps y-values into pixel coordinates.
- **canvasRect** (*QRectF*) – Contents rectangle of the canvas
- **from** (*int*) – Index of the first point to be painted

- **to** (*int*) – Index of the last point to be painted. If to < 0 the curve will be painted to its last point.

See also

draw(), *drawDots()*, *drawSteps()*, *drawLines()*

drawDots(*painter*, *xMap*, *yMap*, *canvasRect*, *from_*, *to*)

Draw dots

Parameters

- **painter** (*QPainter*) – Painter
- **xMap** (qwt.scale_map.QwtScaleMap) – Maps x-values into pixel coordinates.
- **yMap** (qwt.scale_map.QwtScaleMap) – Maps y-values into pixel coordinates.
- **canvasRect** (*QRectF*) – Contents rectangle of the canvas
- **from** (*int*) – Index of the first point to be painted
- **to** (*int*) – Index of the last point to be painted. If to < 0 the curve will be painted to its last point.

See also

draw(), *drawSticks()*, *drawSteps()*, *drawLines()*

drawSteps(*painter*, *xMap*, *yMap*, *canvasRect*, *from_*, *to*)

Draw steps

Parameters

- **painter** (*QPainter*) – Painter
- **xMap** (qwt.scale_map.QwtScaleMap) – Maps x-values into pixel coordinates.
- **yMap** (qwt.scale_map.QwtScaleMap) – Maps y-values into pixel coordinates.
- **canvasRect** (*QRectF*) – Contents rectangle of the canvas
- **from** (*int*) – Index of the first point to be painted
- **to** (*int*) – Index of the last point to be painted. If to < 0 the curve will be painted to its last point.

See also

draw(), *drawSticks()*, *drawDots()*, *drawLines()*

setCurveAttribute(*attribute*, *on=True*)

Specify an attribute for drawing the curve

Supported curve attributes:

- *QwtPlotCurve.Inverted*

Parameters

- **attribute** (*int*) – Curve attribute
- **on** (*bool*) – On/Off

See also

testCurveAttribute()

testCurveAttribute(*attribute*)

Returns
True, if attribute is enabled

See also

setCurveAttribute()

fillCurve(*painter*, *xMap*, *yMap*, *canvasRect*, *polygon*)
Fill the area between the curve and the baseline with the curve brush

Parameters

- **painter** (*QPainter*) – Painter
- **xMap** (qwt.scale_map.QwtScaleMap) – Maps x-values into pixel coordinates.
- **yMap** (qwt.scale_map.QwtScaleMap) – Maps y-values into pixel coordinates.
- **canvasRect** (*QRectF*) – Contents rectangle of the canvas
- **polygon** (*QPolygonF*) – Polygon - will be modified !

See also

setBrush(), *setBaseline()*, *setStyle()*

closePolyline(*painter*, *xMap*, *yMap*, *polygon*)
Complete a polygon to be a closed polygon including the area between the original polygon and the baseline.

Parameters

- **painter** (*QPainter*) – Painter
- **xMap** (qwt.scale_map.QwtScaleMap) – Maps x-values into pixel coordinates.
- **yMap** (qwt.scale_map.QwtScaleMap) – Maps y-values into pixel coordinates.
- **polygon** (*QPolygonF*) – Polygon to be completed

drawSymbols(*painter*, *symbol*, *xMap*, *yMap*, *canvasRect*, *from_*, *to*)
Draw symbols

Parameters

- **painter** (*QPainter*) – Painter
- **symbol** (qwt.symbol.QwtSymbol) – Curve symbol

- **xMap** (qwt.scale_map.QwtScaleMap) – Maps x-values into pixel coordinates.
- **yMap** (qwt.scale_map.QwtScaleMap) – Maps y-values into pixel coordinates.
- **canvasRect** (*QRectF*) – Contents rectangle of the canvas
- **from** (*int*) – Index of the first point to be painted
- **to** (*int*) – Index of the last point to be painted. If to < 0 the curve will be painted to its last point.

See also

setSymbol(), *drawSeries()*, *drawCurve()*

setBaseline(*value*)

Set the value of the baseline

The baseline is needed for filling the curve with a brush or the Sticks drawing style.

The interpretation of the baseline depends on the *orientation()*. With *Qt.Horizontal*, the baseline is interpreted as a horizontal line at y = baseline(), with *Qt.Vertical*, it is interpreted as a vertical line at x = baseline().

The default value is 0.0.

Parameters
value (*float*) – Value of the baseline

See also

baseline(), *setBrush()*, *setStyle()*

baseline()

Returns
Value of the baseline

See also

setBaseline()

closestPoint(*pos*)

Find the closest curve point for a specific position

Parameters
pos (*QPoint*) – Position, where to look for the closest curve point

Returns
tuple *(index, dist)*

dist is the distance between the position and the closest curve point. *index* is the index of the closest curve point, or -1 if none can be found (f.e when the curve has no points).

> **Note**
>
> *closestPoint()* implements a dumb algorithm, that iterates over all points

legendIcon(*index*, *size*)

Parameters

- **index** (*int*) – Index of the legend entry (ignored as there is only one)
- **size** (*QSizeF*) – Icon size

Returns

Icon representing the curve on the legend

> **See also**
>
> *qwt.plot.QwtPlotItem.setLegendIconSize()*, *qwt.plot.QwtPlotItem.legendData()*

setData(**args*, ***kwargs*)

Initialize data with a series data object or an array of points.

setData(data):

Parameters

data (*.plot_series.QwtSeriesData*) – Series data (e.g. *QwtPointArrayData* instance)

setData(xData, yData, [size=None], [finite=True]):

Initialize data with *x* and *y* arrays.

This signature was removed in Qwt6 and is temporarily maintained here to ensure compatibility with Qwt5.

Same as *setSamples(x, y, [size=None], [finite=True])*

Parameters

- **x** – List/array of x values
- **y** – List/array of y values
- **size** (*int or None*) – size of xData and yData
- **finite** (*bool*) – if True, keep only finite array elements (remove all infinity and not a number values), otherwise do not filter array elements

> **See also**
>
> *setSamples()*

setSamples(**args*, ***kwargs*)

Initialize data with an array of points.

setSamples(data):

Parameters

data (*.plot_series.QwtSeriesData*) – Series data (e.g. *QwtPointArrayData* instance)

setSamples(samples):

Same as *setData(QwtPointArrayData(samples))*

Parameters

samples – List/array of points

setSamples(xData, yData, [size=None], [finite=True]):

Same as *setData(QwtPointArrayData(xData, yData, [size=None]))*

Parameters

- **xData** – List/array of x values
- **yData** – List/array of y values
- **size** (*int or None*) – size of xData and yData
- **finite** (*bool*) – if True, keep only finite array elements (remove all infinity and not a number values), otherwise do not filter array elements

See also

plot_series.QwtPointArrayData

5.2.3 QwtPlotMarker

class qwt.plot_marker.**QwtPlotMarker**(*title=None*)

A class for drawing markers

A marker can be a horizontal line, a vertical line, a symbol, a label or any combination of them, which can be drawn around a center point inside a bounding rectangle.

The *setSymbol()* member assigns a symbol to the marker. The symbol is drawn at the specified point.

With *setLabel()*, a label can be assigned to the marker. The *setLabelAlignment()* member specifies where the label is drawn. All the Align*-constants in *Qt.AlignmentFlags* (see Qt documentation) are valid. The interpretation of the alignment depends on the marker's line style. The alignment refers to the center point of the marker, which means, for example, that the label would be printed left above the center point if the alignment was set to *Qt.AlignLeft* | *Qt.AlignTop*.

Line styles:

- *QwtPlotMarker.NoLine*: No line
- *QwtPlotMarker.HLine*: A horizontal line
- *QwtPlotMarker.VLine*: A vertical line
- *QwtPlotMarker.Cross*: A crosshair

classmethod make(*xvalue=None*, *yvalue=None*, *title=None*, *label=None*, *symbol=None*, *plot=None*, *z=None*, *x_axis=None*, *y_axis=None*, *align=None*, *orientation=None*, *spacing=None*, *linestyle=None*, *color=None*, *width=None*, *style=None*, *antialiased=False*)

Create and setup a new *QwtPlotMarker* object (convenience function).

Parameters

- **xvalue** (*float or None*) – x position (optional, default: None)
- **yvalue** (*float or None*) – y position (optional, default: None)
- **title** (qwt.text.QwtText *or str or None*) – Marker title
- **label** (qwt.text.QwtText *or str or None*) – Label text
- **symbol** (qwt.symbol.QwtSymbol *or None*) – New symbol
- **plot** (qwt.plot.QwtPlot *or None*) – Plot to attach the curve to
- **z** (*float or None*) – Z-value
- **x_axis** (*int*) – curve X-axis (default: QwtPlot.yLeft)

- **y_axis** (*int*) – curve Y-axis (default: QwtPlot.xBottom)
- **align** (*Qt.Alignment or None*) – Alignment of the label
- **orientation** (*Qt.Orientation or None*) – Orientation of the label
- **spacing** (*int or None*) – Spacing (distance between the position and the label)
- **linestyle** (*int*) – Line style
- **color** (*QColor or str or None*) – Pen color
- **width** (*float*) – Pen width
- **style** (*Qt.PenStyle*) – Pen style
- **antialiased** (*bool*) – if True, enable antialiasing rendering

See also

`setData()`, `setPen()`, `attach()`

rtti()

Returns
QwtPlotItem.Rtti_PlotMarker

value()

Returns
Value

xValue()

Returns
x Value

yValue()

Returns
y Value

setValue(**args*)

Set Value

setValue(pos):

Parameters
pos (*QPointF*) – Position

setValue(x, y):

Parameters
- **x** (*float*) – x position
- **y** (*float*) – y position

setXValue(*x*)

Set X Value

Parameters
x (*float*) – x position

setYValue(*y*)

Set Y Value

Parameters
y (*float*) – y position

draw(*painter*, *xMap*, *yMap*, *canvasRect*)

Draw the marker

Parameters

- **painter** (*QPainter*) – Painter
- **xMap** (qwt.scale_map.QwtScaleMap) – x Scale Map
- **yMap** (qwt.scale_map.QwtScaleMap) – y Scale Map
- **canvasRect** (*QRectF*) – Contents rectangle of the canvas in painter coordinates

drawLines(*painter*, *canvasRect*, *pos*)

Draw the lines marker

Parameters

- **painter** (*QPainter*) – Painter
- **canvasRect** (*QRectF*) – Contents rectangle of the canvas in painter coordinates
- **pos** (*QPointF*) – Position of the marker, translated into widget coordinates

See also

drawLabel(), *qwt.symbol.QwtSymbol.drawSymbol()*

drawLabel(*painter*, *canvasRect*, *pos*)

Align and draw the text label of the marker

Parameters

- **painter** (*QPainter*) – Painter
- **canvasRect** (*QRectF*) – Contents rectangle of the canvas in painter coordinates
- **pos** (*QPointF*) – Position of the marker, translated into widget coordinates

See also

drawLabel(), *qwt.symbol.QwtSymbol.drawSymbol()*

setLineStyle(*style*)

Set the line style

Parameters
style (*int*) – Line style

Line styles:

- *QwtPlotMarker.NoLine*: No line
- *QwtPlotMarker.HLine*: A horizontal line

- *QwtPlotMarker.VLine*: A vertical line
- *QwtPlotMarker.Cross*: A crosshair

See also

lineStyle()

lineStyle()

Returns
the line style

See also

setLineStyle()

setSymbol(*symbol*)

Assign a symbol

Parameters
symbol (qwt.symbol.QwtSymbol) – New symbol

See also

symbol()

symbol()

Returns
the symbol

See also

setSymbol()

setLabel(*label*)

Set the label

Parameters
label (qwt.text.QwtText *or* *str*) – Label text

See also

label()

label()

Returns
the label

> **See also**
>
> *setLabel()*

setLabelAlignment(*align*)

Set the alignment of the label

In case of *QwtPlotMarker.HLine* the alignment is relative to the y position of the marker, but the horizontal flags correspond to the canvas rectangle. In case of *QwtPlotMarker.VLine* the alignment is relative to the x position of the marker, but the vertical flags correspond to the canvas rectangle.

In all other styles the alignment is relative to the marker's position.

Parameters
align (*Qt.Alignment*) – Alignment

> **See also**
>
> *labelAlignment()*, *labelOrientation()*

labelAlignment()

Returns
the label alignment

> **See also**
>
> *setLabelAlignment()*, *setLabelOrientation()*

setLabelOrientation(*orientation*)

Set the orientation of the label

When orientation is *Qt.Vertical* the label is rotated by 90.0 degrees (from bottom to top).

Parameters
orientation (*Qt.Orientation*) – Orientation of the label

> **See also**
>
> *labelOrientation()*, *setLabelAlignment()*

labelOrientation()

Returns
the label orientation

> **See also**
>
> *setLabelOrientation()*, *labelAlignment()*

setSpacing(*spacing*)

Set the spacing

When the label is not centered on the marker position, the spacing is the distance between the position and the label.

Parameters
spacing (*int*) – Spacing

See also

spacing(), *setLabelAlignment()*

spacing()

Returns
the spacing

See also

setSpacing()

setLinePen(**args*)

Build and/or assigna a line pen, depending on the arguments.

setLinePen(*color*, *width*, *style*)

Build and assign a line pen

In Qt5 the default pen width is 1.0 (0.0 in Qt4) what makes it non cosmetic (see *QPen.isCosmetic()*). This method signature has been introduced to hide this incompatibility.

Parameters
- **color** (*QColor*) – Pen color
- **width** (*float*) – Pen width
- **style** (*Qt.PenStyle*) – Pen style

setLinePen(*pen*)

Specify a pen for the line.

Parameters
pen (*QPen*) – New pen

See also

pen(), brush()

linePen()

Returns
the line pen

See also

setLinePen()

boundingRect()

Returns
An invalid bounding rect: QRectF(1.0, 1.0, -2.0, -2.0)

Note

A width or height < 0.0 is ignored by the autoscaler

legendIcon(*index*, *size*)

Parameters

- **index** (*int*) – Index of the legend entry (ignored as there is only one)
- **size** (*QSizeF*) – Icon size

Returns
Icon representing the marker on the legend

See also

qwt.plot.QwtPlotItem.setLegendIconSize(), *qwt.plot.QwtPlotItem.legendData()*

5.3 Additional plot features

5.3.1 QwtLegend

class qwt.legend.**QwtLegendData**

Attributes of an entry on a legend

QwtLegendData is an abstract container (like *QAbstractModel*) to exchange attributes, that are only known between to the plot item and the legend.

By overloading *QwtPlotItem.legendData()* any other set of attributes could be used, that can be handled by a modified (or completely different) implementation of a legend.

See also

qwt.legend.QwtLegend

Note

The stockchart example implements a legend as a tree with checkable items

setValues(*map_*)

Set the legend attributes

Parameters
map (*dict*) – Values

See also

values()

values()

Returns
Legend attributes

See also

setValues()

hasRole(*role*)

Parameters
role (*int*) – Attribute role

Returns
True, when the internal map has an entry for role

setValue(*role*, *data*)

Set an attribute value

Parameters

- **role** (*int*) – Attribute role
- **data** (*QVariant*) – Attribute value

See also

value()

value(*role*)

Parameters
role (*int*) – Attribute role

Returns
Attribute value for a specific role

See also

setValue()

isValid()

Returns
True, when the internal map is empty

title()

Returns
Value of the TitleRole attribute

icon()

Returns
Value of the IconRole attribute

mode()

Returns
Value of the ModeRole attribute

class qwt.legend.**QwtLegendLabel**(*parent=None*)

A widget representing something on a QwtLegend.

setData(*legendData*)

Set the attributes of the legend label

Parameters
legendData (QwtLegendData) – Attributes of the label

See also

data()

data()

Returns
Attributes of the label

See also

setData(), *qwt.plot.QwtPlotItem.legendData()*

setText(*text*)

Set the text to the legend item

Parameters
text (qwt.text.QwtText) – Text label

See also

text()

setItemMode(*mode*)

Set the item mode. The default is *QwtLegendData.ReadOnly*.

Parameters
mode (*int*) – Item mode

See also
itemMode()

itemMode()

Returns
Item mode

See also
setItemMode()

setIcon(*icon*)

Assign the icon

Parameters
icon (*QPixmap*) – Pixmap representing a plot item

See also
icon(), *qwt.plot.QwtPlotItem.legendIcon()*

icon()

Returns
Pixmap representing a plot item

See also
setIcon()

setSpacing(*spacing*)

Change the spacing between icon and text

Parameters
spacing (*int*) – Spacing

See also
spacing(), *qwt.text.QwtTextLabel.margin()*

spacing()

Returns
Spacing between icon and text

See also

setSpacing()

setChecked(*on*)

Check/Uncheck a the item

Parameters
on (*bool*) – check/uncheck

See also

isChecked(), *setItemMode()*

isChecked()

Returns
true, if the item is checked

See also

setChecked()

setDown(*down*)

Set the item being down

Parameters
on (*bool*) – true, if the item is down

See also

isDown()

isDown()

Returns
true, if the item is down

See also

setDown()

sizeHint()

Returns
a size hint

paintEvent(*self*, *a0: QPaintEvent | None*)

mousePressEvent(*self*, *a0: QMouseEvent | None*)

mouseReleaseEvent(*self*, *a0: QMouseEvent | None*)

keyPressEvent(*self*, *a0: QKeyEvent | None*)

keyReleaseEvent(*self*, *a0: QKeyEvent | None*)

class qwt.legend.**QwtLegend**(*parent=None*)

The legend widget

The QwtLegend widget is a tabular arrangement of legend items. Legend items might be any type of widget, but in general they will be a QwtLegendLabel.

See also

:py:class`qwt.legend.QwtLegendLabel`, :py:class`qwt.plot.QwtPlotItem`, :py:class`qwt.plot.QwtPlot`

class QwtLegend([*parent=None*])

Constructor

Parameters

parent (*QWidget*) – Parent widget

clicked

A signal which is emitted when the user has clicked on a legend label, which is in *QwtLegendData.Clickable* mode.

Parameters

- **itemInfo** – Info for the item item of the selected legend item
- **index** – Index of the legend label in the list of widgets that are associated with the plot item

Note

Clicks are disabled as default

checked

A signal which is emitted when the user has clicked on a legend label, which is in *QwtLegendData.Checkable* mode

Parameters

- **itemInfo** – Info for the item of the selected legend label
- **index** – Index of the legend label in the list of widgets that are associated with the plot item
- **on** – True when the legend label is checked

Note

Clicks are disabled as default

setMaxColumns(*numColumns*)

Set the maximum number of entries in a row

F.e when the maximum is set to 1 all items are aligned vertically. 0 means unlimited

Parameters
numColumns (*int*) – Maximum number of entries in a row

See also

maxColumns(), QwtDynGridLayout.setMaxColumns()

maxColumns()

Returns
Maximum number of entries in a row

See also

setMaxColumns(), QwtDynGridLayout.maxColumns()

setDefaultItemMode(*mode*)

Set the default mode for legend labels

Legend labels will be constructed according to the attributes in a *QwtLegendData* object. When it doesn't contain a value for the *QwtLegendData.ModeRole* the label will be initialized with the default mode of the legend.

Parameters
mode (*int*) – Default item mode

See also

itemMode(), *QwtLegendData.value()*, QwtPlotItem::legendData()

... note:

```
Changing the mode doesn't have any effect on existing labels.
```

defaultItemMode()

Returns
Default item mode

See also

setDefaultItemMode()

contentsWidget()

The contents widget is the only child of the viewport of the internal *QScrollArea* and the parent widget of all legend items.

Returns
Container widget of the legend items

`horizontalScrollBar`()

Returns
Horizontal scrollbar

See also

verticalScrollBar()

`verticalScrollBar`()

Returns
Vertical scrollbar

See also

horizontalScrollBar()

`updateLegend`(*itemInfo*, *data*)

Update the entries for an item

Parameters

- **itemInfo** (*QVariant*) – Info for an item
- **data** (*list*) – Default item mode

`createWidget`(*data*)

Create a widget to be inserted into the legend

The default implementation returns a *QwtLegendLabel*.

Parameters
data (QwtLegendData) – Attributes of the legend entry

Returns
Widget representing data on the legend

... note:

```
updateWidget() will called soon after createWidget()
with the same attributes.
```

`updateWidget`(*widget*, *data*)

Update the widget

Parameters

- **widget** (*QWidget*) – Usually a QwtLegendLabel
- **data** (QwtLegendData) – Attributes to be displayed

> **See also**
>
> *createWidget()*

... note:

```
When widget is no QwtLegendLabel updateWidget() does nothing.
```

sizeHint()

Return a size hint

heightForWidth(*width*)

Parameters
width (*int*) – Width

Returns
The preferred height, for a width.

eventFilter(*object_*, *event*)

Handle QEvent.ChildRemoved andQEvent.LayoutRequest events for the contentsWidget().

Parameters

- **object** (*QObject*) – Object to be filtered
- **event** (*QEvent*) – Event

Returns
Forwarded to QwtAbstractLegend.eventFilter()

renderLegend(*painter*, *rect*, *fillBackground*)

Render the legend into a given rectangle.

Parameters

- **painter** (*QPainter*) – Painter
- **rect** (*QRectF*) – Bounding rectangle
- **fillBackground** (*bool*) – When true, fill rect with the widget background

renderItem(*painter*, *widget*, *rect*, *fillBackground*)

Render a legend entry into a given rectangle.

Parameters

- **painter** (*QPainter*) – Painter
- **widget** (*QWidget*) – Widget representing a legend entry
- **rect** (*QRectF*) – Bounding rectangle
- **fillBackground** (*bool*) – When true, fill rect with the widget background

legendWidgets(*itemInfo*)

List of widgets associated to a item

Parameters
itemInfo (*QVariant*) – Info about an item

legendWidget(*itemInfo*)

First widget in the list of widgets associated to an item

Parameters
itemInfo (*QVariant*) – Info about an item

itemInfo(*widget*)

Find the item that is associated to a widget

Parameters
widget (*QWidget*) – Widget on the legend

Returns
Associated item info

5.3.2 Color maps

QwtColorMap

class qwt.color_map.**QwtColorMap**(*format_=None*)

QwtColorMap is used to map values into colors.

For displaying 3D data on a 2D plane the 3rd dimension is often displayed using colors, like f.e in a spectrogram.

Each color map is optimized to return colors for only one of the following image formats:

- *QImage.Format_Indexed8*
- *QImage.Format_ARGB32*

class QwtColorMap(*format_*)

Parameters
format (*int*) – Preferred format of the color map (`QwtColorMap.RGB` or `QwtColorMap.Indexed`)

See also

`qwt.QwtScaleWidget`

color(*interval*, *value*)

Map a value into a color

Parameters

- **interval** (`qwt.interval.QwtInterval`) – valid interval for value
- **value** (*float*) – value

Returns
the color corresponding to value

Warning

This method is slow for Indexed color maps. If it is necessary to map many values, its better to get the color table once and find the color using *colorIndex()*.

colorTable(*interval*)

Build and return a color map of 256 colors

Parameters
interval (qwt.interval.QwtInterval) – range for the values

Returns
a color table, that can be used for a *QImage*

The color table is needed for rendering indexed images in combination with using *colorIndex()*.

QwtLinearColorMap

class qwt.color_map.**QwtLinearColorMap**(**args*)

Build a linear color map with two stops.

class QwtLinearColorMap(*format_*)

Build a color map with two stops at 0.0 and 1.0. The color at 0.0 is *Qt.blue*, at 1.0 it is *Qt.yellow*.

Parameters
format (*int*) – Preferred format of the color map (QwtColorMap.RGB or QwtColorMap.Indexed)

QwtLinearColorMap(color1, color2, [format_=QwtColorMap.RGB]):

Build a color map with two stops at 0.0 and 1.0.

Parameters

- **color1** (*QColor*) – color at 0.
- **color2** (*QColor*) – color at 1.
- **format** (*int*) – Preferred format of the color map (QwtColorMap.RGB or QwtColorMap.Indexed)

QwtLinearColorMap.**setMode**(*mode*)

Set the mode of the color map

Parameters
mode (*int*) – QwtLinearColorMap.FixedColors or QwtLinearColorMap.ScaledColors

FixedColors means the color is calculated from the next lower color stop. *ScaledColors* means the color is calculated by interpolating the colors of the adjacent stops.

QwtLinearColorMap.**mode**()

Returns
the mode of the color map

See also

QwtLinearColorMap.setMode()

QwtAlphaColorMap

class qwt.color_map.**QwtAlphaColorMap**(*color*)

QwtAlphaColorMap varies the alpha value of a color

class QwtAlphaColorMap(*color*)

Build a color map varying the alpha value of a color.

Parameters
color (*QColor*) – color of the map

setColor(*color*)

Set the color of the map

Parameters
color (*QColor*) – color of the map

color()

Returns
the color of the map

See also

QwtAlphaColorMap.setColor()

5.3.3 QwtPlotRenderer

class qwt.plot_renderer.**QwtPlotRenderer**(*parent=None*)

Renderer for exporting a plot to a document, a printer or anything else, that is supported by QPainter/QPaintDevice

Discard flags:

- *QwtPlotRenderer.DiscardNone*: Render all components of the plot
- *QwtPlotRenderer.DiscardBackground*: Don't render the background of the plot
- *QwtPlotRenderer.DiscardTitle*: Don't render the title of the plot
- *QwtPlotRenderer.DiscardLegend*: Don't render the legend of the plot
- *QwtPlotRenderer.DiscardCanvasBackground*: Don't render the background of the canvas
- *QwtPlotRenderer.DiscardFooter*: Don't render the footer of the plot
- *QwtPlotRenderer.DiscardCanvasFrame*: Don't render the frame of the canvas

Note

The *QwtPlotRenderer.DiscardCanvasFrame* flag has no effect when using style sheets, where the frame is part of the background

Layout flags:

- *QwtPlotRenderer.DefaultLayout*: Use the default layout as on screen
- *QwtPlotRenderer.FrameWithScales*: Instead of the scales a box is painted around the plot canvas, where the scale ticks are aligned to.

setDiscardFlag(*flag*, *on=True*)

Change a flag, indicating what to discard from rendering

Parameters

- **flag** (*int*) – Flag to change
- **on** (*bool*) – On/Off

See also

testDiscardFlag(), *setDiscardFlags()*, *discardFlags()*

testDiscardFlag(*flag*)

Parameters
flag (*int*) – Flag to be tested

Returns
True, if flag is enabled.

See also

setDiscardFlag(), *setDiscardFlags()*, *discardFlags()*

setDiscardFlags(*flags*)

Set the flags, indicating what to discard from rendering

Parameters
flags (*int*) – Flags

See also

testDiscardFlag(), *setDiscardFlag()*, *discardFlags()*

discardFlags()

Returns
Flags, indicating what to discard from rendering

See also

setDiscardFlag(), *setDiscardFlags()*, *testDiscardFlag()*

setLayoutFlag(*flag*, *on=True*)

Change a layout flag

Parameters
flag (*int*) – Flag to change

See also

testLayoutFlag(), *setLayoutFlags()*, *layoutFlags()*

testLayoutFlag(*flag*)

Parameters
flag (*int*) – Flag to be tested

Returns
True, if flag is enabled.

See also

setLayoutFlag(), *setLayoutFlags()*, *layoutFlags()*

setLayoutFlags(*flags*)

Set the layout flags

Parameters
flags (*int*) – Flags

See also

setLayoutFlag(), *testLayoutFlag()*, *layoutFlags()*

layoutFlags()

Returns
Layout flags

See also

setLayoutFlags(), *setLayoutFlag()*, *testLayoutFlag()*

renderDocument(*plot*, *filename*, *sizeMM=(300, 200)*, *resolution=85*, *format_=None*)

Render a plot to a file

The format of the document will be auto-detected from the suffix of the file name.

Parameters

- **plot** (qwt.plot.QwtPlot) – Plot widget
- **fileName** (*str*) – Path of the file, where the document will be stored
- **sizeMM** (*QSizeF*) – Size for the document in millimeters
- **resolution** (*int*) – Resolution in dots per Inch (dpi)

renderTo(*plot*, *dest*)

Render a plot to a file

Supported formats are:

- pdf: Portable Document Format PDF
- ps: Postcript
- svg: Scalable Vector Graphics SVG
- all image formats supported by Qt, see QImageWriter.supportedImageFormats()

Scalable vector graphic formats like PDF or SVG are superior to raster graphics formats.

Parameters

- **plot** (qwt.plot.QwtPlot) – Plot widget
- **dest** – QPaintDevice, QPrinter or QSvgGenerator instance

See also

render(), qwt.painter.QwtPainter.setRoundingAlignment()

render(*plot*, *painter*, *plotRect*)

Paint the contents of a QwtPlot instance into a given rectangle.

Parameters

- **plot** (qwt.plot.QwtPlot) – Plot to be rendered
- **painter** (*QPainter*) – Painter
- **format** (*str*) – Format for the document
- **plotRect** (*QRectF*) – Bounding rectangle

See also

renderDocument(), *renderTo()*, qwt.painter.QwtPainter.setRoundingAlignment()

renderTitle(*plot*, *painter*, *rect*)

Render the title into a given rectangle.

Parameters

- **plot** (qwt.plot.QwtPlot) – Plot widget
- **painter** (*QPainter*) – Painter
- **rect** (*QRectF*) – Bounding rectangle

renderFooter(*plot*, *painter*, *rect*)

Render the footer into a given rectangle.

Parameters

- **plot** (qwt.plot.QwtPlot) – Plot widget
- **painter** (*QPainter*) – Painter
- **rect** (*QRectF*) – Bounding rectangle

renderLegend(*plot*, *painter*, *rect*)

Render the legend into a given rectangle.

Parameters

- **plot** (qwt.plot.QwtPlot) – Plot widget
- **painter** (*QPainter*) – Painter
- **rect** (*QRectF*) – Bounding rectangle

renderScale(*plot*, *painter*, *axisId*, *startDist*, *endDist*, *baseDist*, *rect*)

Paint a scale into a given rectangle. Paint the scale into a given rectangle.

Parameters

- **plot** (qwt.plot.QwtPlot) – Plot widget
- **painter** (*QPainter*) – Painter
- **axisId** (*int*) – Axis
- **startDist** (*int*) – Start border distance
- **endDist** (*int*) – End border distance
- **baseDist** (*int*) – Base distance
- **rect** (*QRectF*) – Bounding rectangle

renderCanvas(*plot*, *painter*, *canvasRect*, *maps*)

Render the canvas into a given rectangle.

Parameters

- **plot** (qwt.plot.QwtPlot) – Plot widget
- **painter** (*QPainter*) – Painter
- **rect** (*QRectF*) – Bounding rectangle
- **maps** (qwt.scale_map.QwtScaleMap) – mapping between plot and paint device coordinates

buildCanvasMaps(*plot*, *canvasRect*)

Calculated the scale maps for rendering the canvas

Parameters

- **plot** (qwt.plot.QwtPlot) – Plot widget
- **canvasRect** (*QRectF*) – Target rectangle

Returns

Calculated scale maps

exportTo(*plot*, *documentname*, *sizeMM=None*, *resolution=85*)

Execute a file dialog and render the plot to the selected file

Parameters

- **plot** (qwt.plot.QwtPlot) – Plot widget
- **documentName** (*str*) – Default document name
- **sizeMM** (*QSizeF*) – Size for the document in millimeters
- **resolution** (*int*) – Resolution in dots per Inch (dpi)

Returns

True, when exporting was successful

See also

renderDocument()

5.4 Scales

5.4.1 QwtScaleMap

class qwt.scale_map.**QwtScaleMap**(**args*)

A scale map

QwtScaleMap offers transformations from the coordinate system of a scale into the linear coordinate system of a paint device and vice versa.

The scale and paint device intervals are both set to [0,1].

class QwtScaleMap([*other=None*])

Constructor (eventually, copy constructor)

Parameters
other (qwt.scale_map.QwtScaleMap) – Other scale map

class QwtScaleMap(*p1*, *p2*, *s1*, *s2*)

Constructor (was provided by *PyQwt* but not by *Qwt*)

Parameters

- **p1** (*int*) – First border of the paint interval
- **p2** (*int*) – Second border of the paint interval
- **s1** (*float*) – First border of the scale interval
- **s2** (*float*) – Second border of the scale interval

s1()

Returns
First border of the scale interval

s2()

Returns
Second border of the scale interval

p1()

Returns
First border of the paint interval

p2()

Returns
Second border of the paint interval

pDist()

Returns
abs(p2() - p1())

sDist()

Returns
abs(s2() - s1())

transform_scalar(*s*)

Transform a point related to the scale interval into an point related to the interval of the paint device

Parameters
s (*float*) – Value relative to the coordinates of the scale

Returns
Transformed value

See also

invTransform_scalar()

invTransform_scalar(*p*)

Transform an paint device value into a value in the interval of the scale.

Parameters
p (*float*) – Value relative to the coordinates of the paint device

Returns
Transformed value

See also

transform_scalar()

isInverting()

Returns
True, when (p1() < p2()) != (s1() < s2())

setTransformation(*transform*)

Initialize the map with a transformation

Parameters
transform (qwt.transform.QwtTransform) – Transformation

transformation()

Returns
the transformation

setScaleInterval(*s1*, *s2*)

Specify the borders of the scale interval

Parameters

- **s1** (*float*) – first border
- **s2** (*float*) – second border

Warning

Scales might be aligned to transformation depending boundaries

setPaintInterval(*p1*, *p2*)

Specify the borders of the paint device interval

Parameters

- **p1** (*float*) – first border
- **p2** (*float*) – second border

transform(**args*)

Transform a rectangle from scale to paint coordinates.

Transfom a scalar:

Parameters
scalar (*float*) – Scalar

Transfom a rectangle:

Parameters

- **xMap** (qwt.scale_map.QwtScaleMap) – X map
- **yMap** (qwt.scale_map.QwtScaleMap) – Y map
- **rect** (*QRectF*) – Rectangle in paint coordinates

Transfom a point:

Parameters

- **xMap** (qwt.scale_map.QwtScaleMap) – X map
- **yMap** (qwt.scale_map.QwtScaleMap) – Y map
- **pos** (*QPointF*) – Position in scale coordinates

See also

invTransform()

invTransform(**args*)

Transform from paint to scale coordinates

Scalar: scalemap.invTransform(scalar) Point (QPointF): scalemap.invTransform(xMap, yMap, pos) Rectangle (QRectF): scalemap.invTransform(xMap, yMap, rect)

5.4.2 QwtScaleWidget

class qwt.scale_widget.**QwtScaleWidget**(**args*)

A Widget which contains a scale

This Widget can be used to decorate composite widgets with a scale.

Layout flags:

- *QwtScaleWidget.TitleInverted*: The title of vertical scales is painted from top to bottom. Otherwise it is painted from bottom to top.

class QwtScaleWidget([*parent=None*])

Alignment default is *QwtScaleDraw.LeftScale*.

Parameters
parent (*QWidget or None*) – Parent widget

class QwtScaleWidget(*align*, *parent*)

Parameters

- **align** (*int*) – Alignment
- **parent** (*QWidget*) – Parent widget

initScale(*align*)

Initialize the scale

Parameters
align (*int*) – Alignment

setLayoutFlag(*flag*, *on=True*)

Toggle an layout flag

Parameters

- **flag** (*int*) – Layout flag
- **on** (*bool*) – True/False

See also

testLayoutFlag()

testLayoutFlag(*flag*)

Test a layout flag

Parameters
flag (*int*) – Layout flag

Returns
True/False

See also

setLayoutFlag()

setTitle(*title*)

Give title new text contents

Parameters
title (*qwt.text.QwtText or str*) – New title

See also

title()

setAlignment(*alignment*)

Change the alignment

Parameters
alignment (*int*) – New alignment

Valid alignment values: see *qwt.scale_draw.QwtScaleDraw*

See also

alignment()

alignment()

Returns
position

See also

setAlignment()

setBorderDist(*dist1*, *dist2*)

Specify distances of the scale's endpoints from the widget's borders. The actual borders will never be less than minimum border distance.

Parameters

- **dist1** (*int*) – Left or top Distance
- **dist2** (*int*) – Right or bottom distance

See also

`borderDist()`

setMargin(*margin*)

Specify the margin to the colorBar/base line.

Parameters
margin (*int*) – Margin

See also

margin()

setSpacing(*spacing*)

Specify the distance between color bar, scale and title

Parameters
spacing (*int*) – Spacing

See also

spacing()

setLabelAlignment(*alignment*)

Change the alignment for the labels.

Parameters
spacing (*int*) – Spacing

See also

qwt.scale_draw.QwtScaleDraw.setLabelAlignment(), *setLabelRotation()*

setLabelRotation(*rotation*)

Change the rotation for the labels.

Parameters
rotation (*float*) – Rotation

See also

qwt.scale_draw.QwtScaleDraw.setLabelRotation(), setLabelFlags()

setLabelAutoSize(*state*)

Set the automatic size option for labels (default: on).

Parameters
state (*bool*) – On/off

See also

qwt.scale_draw.QwtScaleDraw.setLabelAutoSize()

setScaleDraw(*scaleDraw*)

Set a scale draw

scaleDraw has to be created with new and will be deleted in class destructor or the next call of *setScaleDraw()*. scaleDraw will be initialized with the attributes of the previous scaleDraw object.

Parameters
scaleDraw (qwt.scale_draw.QwtScaleDraw) – ScaleDraw object

See also

scaleDraw()

scaleDraw()

Returns
scaleDraw of this scale

See also

`qwt.scale_draw.QwtScaleDraw.setScaleDraw()`

`title()`

Returns
title

See also

setTitle()

`startBorderDist()`

Returns
start border distance

See also

setBorderDist()

`endBorderDist()`

Returns
end border distance

See also

setBorderDist()

`margin()`

Returns
margin

See also

setMargin()

`spacing()`

Returns
distance between scale and title

See also

setSpacing()

paintEvent(*self*, *a0: QPaintEvent | None*)

draw(*painter*)

Draw the scale

Parameters
painter (*QPainter*) – Painter

colorBarRect(*rect*)

Calculate the the rectangle for the color bar

Parameters
rect (*QRectF*) – Bounding rectangle for all components of the scale

Returns
Rectangle for the color bar

resizeEvent(*self*, *a0: QResizeEvent | None*)

layoutScale(*update_geometry=True*)

Recalculate the scale's geometry and layout based on the current geometry and fonts.

Parameters
update_geometry (*bool*) – Notify the layout system and call update to redraw the scale

drawColorBar(*painter*, *rect*)

Draw the color bar of the scale widget

Parameters

- **painter** (*QPainter*) – Painter
- **rect** (*QRectF*) – Bounding rectangle for the color bar

See also

setColorBarEnabled()

drawTitle(*painter*, *align*, *rect*)

Rotate and paint a title according to its position into a given rectangle.

Parameters

- **painter** (*QPainter*) – Painter
- **align** (*int*) – Alignment
- **rect** (*QRectF*) – Bounding rectangle

scaleChange()

Notify a change of the scale

This method can be overloaded by derived classes. The default implementation updates the geometry and repaints the widget.

sizeHint(*self*) → QSize

minimumSizeHint(*self*) → QSize

`titleHeightForWidth`(*width*)

Find the height of the title for a given width.

Parameters
width (*int*) – Width

Returns
Height

`dimForLength`(*length*, *scaleFont*)

Find the minimum dimension for a given length. dim is the height, length the width seen in direction of the title.

Parameters

- **length** (*int*) – width for horizontal, height for vertical scales
- **scaleFont** (*QFont*) – Font of the scale

Returns
height for horizontal, width for vertical scales

`getBorderDistHint`()

Calculate a hint for the border distances.

This member function calculates the distance of the scale's endpoints from the widget borders which is required for the mark labels to fit into the widget. The maximum of this distance an the minimum border distance is returned.

Parameters

- **start** (*int*) – Return parameter for the border width at the beginning of the scale
- **end** (*int*) – Return parameter for the border width at the end of the scale

Warning

The minimum border distance depends on the font.

See also

setMinBorderDist(), *getMinBorderDist()*, *setBorderDist()*

`setMinBorderDist`(*start*, *end*)

Set a minimum value for the distances of the scale's endpoints from the widget borders. This is useful to avoid that the scales are "jumping", when the tick labels or their positions change often.

Parameters

- **start** (*int*) – Minimum for the start border
- **end** (*int*) – Minimum for the end border

See also

getMinBorderDist(), *getBorderDistHint()*

getMinBorderDist()

Get the minimum value for the distances of the scale's endpoints from the widget borders.

Parameters

- **start** (*int*) – Return parameter for the border width at the beginning of the scale
- **end** (*int*) – Return parameter for the border width at the end of the scale

See also

setMinBorderDist(), *getBorderDistHint()*

setScaleDiv(*scaleDiv*)

Assign a scale division

The scale division determines where to set the tick marks.

Parameters

scaleDiv (qwt.scale_div.QwtScaleDiv) – Scale Division

See also

For more information about scale divisions, see *qwt.scale_div.QwtScaleDiv*.

setTransformation(*transformation*)

Set the transformation

Parameters

transformation (*qwt.transform.Transform*) – Transformation

See also

qwt.scale_draw.QwtAbstractScaleDraw.scaleDraw(), *qwt.scale_map.QwtScaleMap*

setColorBarEnabled(*on*)

En/disable a color bar associated to the scale

Parameters

on (*bool*) – On/Off

See also

isColorBarEnabled(), *setColorBarWidth()*

isColorBarEnabled()

Returns

True, when the color bar is enabled

See also

setColorBarEnabled(), *setColorBarWidth()*

setColorBarWidth(*width*)

Set the width of the color bar

Parameters
width (*int*) – Width

See also

colorBarWidth(), *setColorBarEnabled()*

colorBarWidth()

Returns
Width of the color bar

See also

setColorBarWidth(), *setColorBarEnabled()*

colorBarInterval()

Returns
Value interval for the color bar

See also

setColorMap(), *colorMap()*

setColorMap(*interval*, *colorMap*)

Set the color map and value interval, that are used for displaying the color bar.

Parameters

- **interval** (qwt.interval.QwtInterval) – Value interval
- **colorMap** (qwt.color_map.QwtColorMap) – Color map

See also

colorMap(), *colorBarInterval()*

colorMap()

Returns
Color map

> **See also**
>
> *setColorMap()*, *colorBarInterval()*

5.4.3 QwtScaleDiv

class qwt.scale_div.**QwtScaleDiv**(**args*)

A class representing a scale division

A Qwt scale is defined by its boundaries and 3 list for the positions of the major, medium and minor ticks.

The *upperLimit()* might be smaller than the *lowerLimit()* to indicate inverted scales.

Scale divisions can be calculated from a *QwtScaleEngine*.

> **See also**
>
> *qwt.scale_engine.QwtScaleEngine.divideScale()*, *qwt.plot.QwtPlot.setAxisScaleDiv()*

Scale tick types:

- *QwtScaleDiv.NoTick*: No ticks
- *QwtScaleDiv.MinorTick*: Minor ticks
- *QwtScaleDiv.MediumTick*: Medium ticks
- *QwtScaleDiv.MajorTick*: Major ticks
- *QwtScaleDiv.NTickTypes*: Number of valid tick types

class QwtScaleDiv

Basic constructor. Lower bound = Upper bound = 0.

class QwtScaleDiv(*interval*, *ticks*)

Parameters

- **interval** (qwt.interval.QwtInterval) – Interval
- **ticks** (*list*) – list of major, medium and minor ticks

class QwtScaleDiv(*lowerBound*, *upperBound*)

Parameters

- **lowerBound** (*float*) – First boundary
- **upperBound** (*float*) – Second boundary

class QwtScaleDiv(*lowerBound*, *upperBound*, *ticks*)

Parameters

- **lowerBound** (*float*) – First boundary
- **upperBound** (*float*) – Second boundary
- **ticks** (*list*) – list of major, medium and minor ticks

class QwtScaleDiv(*lowerBound*, *upperBound*, *minorTicks*, *mediumTicks*, *majorTicks*)

Parameters

- **lowerBound** (*float*) – First boundary
- **upperBound** (*float*) – Second boundary
- **minorTicks** (*list*) – list of minor ticks
- **mediumTicks** (*list*) – list of medium ticks
- **majorTicks** (*list*) – list of major ticks

Note

lowerBound might be greater than upperBound for inverted scales

setInterval(**args*)

Change the interval

setInterval(*lowerBound*, *upperBound*)

Parameters

- **lowerBound** (*float*) – First boundary
- **upperBound** (*float*) – Second boundary

setInterval(*interval*)

Parameters

interval (qwt.interval.QwtInterval) – Interval

Note

lowerBound might be greater than upperBound for inverted scales

interval()

Returns

Interval

setLowerBound(*lowerBound*)

Set the first boundary

Parameters

lowerBound (*float*) – First boundary

See also

lowerBound(), *setUpperBound()*

lowerBound()

Returns

the first boundary

> **See also**
>
> *upperBound()*

setUpperBound(*upperBound*)

Set the second boundary

Parameters
lowerBound (*float*) – Second boundary

> **See also**
>
> *upperBound()*, *setLowerBound()*

upperBound()

Returns
the second boundary

> **See also**
>
> *lowerBound()*

range()

Returns
upperBound() - lowerBound()

isEmpty()

Check if the scale division is empty(lowerBound() == upperBound())

isIncreasing()

Check if the scale division is increasing(lowerBound() <= upperBound())

contains(*value*)

Return if a value is between lowerBound() and upperBound()

Parameters
value (*float*) – Value

Returns
True/False

invert()

Invert the scale division

> **See also**
>
> *inverted()*

inverted()

Returns
A scale division with inverted boundaries and ticks

> **See also**
>
> *invert()*

bounded(*lowerBound*, *upperBound*)

Return a scale division with an interval [lowerBound, upperBound] where all ticks outside this interval are removed

Parameters

- **lowerBound** (*float*) – First boundary
- **lowerBound** – Second boundary

Returns

Scale division with all ticks inside of the given interval

> **Note**
>
> lowerBound might be greater than upperBound for inverted scales

setTicks(*tickType*, *ticks*)

Assign ticks

Parameters

- **type** (*int*) – MinorTick, MediumTick or MajorTick
- **ticks** (*list*) – Values of the tick positions

ticks(*tickType*)

Return a list of ticks

Parameters

type (*int*) – MinorTick, MediumTick or MajorTick

Returns

Tick list

5.4.4 QwtScaleEngine

class qwt.scale_engine.**QwtScaleEngine**(*base=10*)

Base class for scale engines.

A scale engine tries to find "reasonable" ranges and step sizes for scales.

The layout of the scale can be varied with *setAttribute()*.

PythonQwt offers implementations for logarithmic and linear scales.

Layout attributes:

- *QwtScaleEngine.NoAttribute*: No attributes
- *QwtScaleEngine.IncludeReference*: Build a scale which includes the *reference()* value
- *QwtScaleEngine.Symmetric*: Build a scale which is symmetric to the *reference()* value

- *QwtScaleEngine.Floating*: The endpoints of the scale are supposed to be equal the outmost included values plus the specified margins (see *setMargins()*). If this attribute is *not* set, the endpoints of the scale will be integer multiples of the step size.
- *QwtScaleEngine.Inverted*: Turn the scale upside down

autoScale(*maxNumSteps*, *x1*, *x2*, *stepSize*, *relativeMargin=0.0*)

Align and divide an interval

Parameters

- **maxNumSteps** (*int*) – Max. number of steps
- **x1** (*float*) – First limit of the interval (In/Out)
- **x2** (*float*) – Second limit of the interval (In/Out)
- **stepSize** (*float*) – Step size
- **relativeMargin** (*float*) – Margin as a fraction of the interval width

Returns

tuple (x1, x2, stepSize)

divideScale(*x1*, *x2*, *maxMajorSteps*, *maxMinorSteps*, *stepSize=0.0*)

Calculate a scale division

Parameters

- **x1** (*float*) – First interval limit
- **x2** (*float*) – Second interval limit
- **maxMajorSteps** (*int*) – Maximum for the number of major steps
- **maxMinorSteps** (*int*) – Maximum number of minor steps
- **stepSize** (*float*) – Step size. If stepSize == 0.0, the scaleEngine calculates one

Returns

Calculated scale division

setTransformation(*transform*)

Assign a transformation

Parameters

transform (qwt.transform.QwtTransform) – Transformation

The transformation object is used as factory for clones that are returned by *transformation()*

The scale engine takes ownership of the transformation.

See also

QwtTransform.copy(), *transformation()*

transformation()

Create and return a clone of the transformation of the engine. When the engine has no special transformation None is returned, indicating no transformation.

Returns

A clone of the transfomation

> **See also**
>
> *setTransformation()*

lowerMargin()

Returns
the margin at the lower end of the scale

The default margin is 0.

> **See also**
>
> *setMargins()*

upperMargin()

Returns
the margin at the upper end of the scale

The default margin is 0.

> **See also**
>
> *setMargins()*

setMargins(*lower*, *upper*)

Specify margins at the scale's endpoints

Parameters

- **lower** (*float*) – minimum distance between the scale's lower boundary and the smallest enclosed value
- **upper** (*float*) – minimum distance between the scale's upper boundary and the greatest enclosed value

Returns
A clone of the transfomation

Margins can be used to leave a minimum amount of space between the enclosed intervals and the boundaries of the scale.

> **Warning**
>
> *QwtLogScaleEngine* measures the margins in decades.

> **See also**
>
> *upperMargin()*, *lowerMargin()*

divideInterval(*intervalSize*, *numSteps*)

Calculate a step size for a given interval

Parameters

- **intervalSize** (*float*) – Interval size
- **numSteps** (*float*) – Number of steps

Returns
Step size

contains(*interval*, *value*)

Check if an interval “contains” a value

Parameters

- **intervalSize** (*float*) – Interval size
- **value** (*float*) – Value

Returns
True, when the value is inside the interval

strip(*ticks*, *interval*)

Remove ticks from a list, that are not inside an interval

Parameters

- **ticks** (*list*) – Tick list
- **interval** (qwt.interval.QwtInterval) – Interval

Returns
Stripped tick list

buildInterval(*value*)

Build an interval around a value

In case of v == 0.0 the interval is [-0.5, 0.5], otherwide it is [0.5 * v, 1.5 * v]

Parameters
value (*float*) – Initial value

Returns
Calculated interval

setAttribute(*attribute*, *on=True*)

Change a scale attribute

Parameters

- **attribute** (*int*) – Attribute to change
- **on** (*bool*) – On/Off

Returns
Calculated interval

See also

testAttribute()

testAttribute(*attribute*)

Parameters
attribute (*int*) – Attribute to be tested

Returns
True, if attribute is enabled

See also
setAttribute()

setAttributes(*attributes*)
Change the scale attribute

Parameters
attributes – Set scale attributes

See also
attributes()

attributes()

Returns
Scale attributes

See also
setAttributes(), *testAttribute()*

setReference(*r*)
Specify a reference point

Parameters
r (*float*) – new reference value

The reference point is needed if options *IncludeReference* or *Symmetric* are active. Its default value is 0.0.

reference()

Returns
the reference value

See also
setReference(), *setAttribute()*

setBase(*base*)
Set the base of the scale engine

While a base of 10 is what 99.9% of all applications need certain scales might need a different base: f.e 2

The default setting is 10

Parameters
base (*int*) – Base of the engine

See also
base()

base()

Returns
Base of the scale engine

See also
setBase()

5.4.5 QwtLinearScaleEngine

class qwt.scale_engine.**QwtLinearScaleEngine**(*base=10*)

A scale engine for linear scales

The step size will fit into the pattern f$left{ 1,2,5right} cdot 10^{n}f$, where n is an integer.

autoScale(*maxNumSteps*, *x1*, *x2*, *stepSize*, *relativeMargin=0.0*)

Align and divide an interval

Parameters
- **maxNumSteps** (*int*) – Max. number of steps
- **x1** (*float*) – First limit of the interval (In/Out)
- **x2** (*float*) – Second limit of the interval (In/Out)
- **stepSize** (*float*) – Step size
- **relativeMargin** (*float*) – Margin as a fraction of the interval width

Returns
tuple (x1, x2, stepSize)

See also
`setAttribute()`

divideScale(*x1*, *x2*, *maxMajorSteps*, *maxMinorSteps*, *stepSize=0.0*)

Calculate a scale division for an interval

Parameters
- **x1** (*float*) – First interval limit
- **x2** (*float*) – Second interval limit
- **maxMajorSteps** (*int*) – Maximum for the number of major steps
- **maxMinorSteps** (*int*) – Maximum number of minor steps

- **stepSize** (*float*) – Step size. If stepSize == 0.0, the scaleEngine calculates one

Returns
Calculated scale division

buildTicks(*interval*, *stepSize*, *maxMinorSteps*)

Calculate ticks for an interval

Parameters

- **interval** (qwt.interval.QwtInterval) – Interval
- **stepSize** (*float*) – Step size
- **maxMinorSteps** (*int*) – Maximum number of minor steps

Returns
Calculated ticks

buildMajorTicks(*interval*, *stepSize*)

Calculate major ticks for an interval

Parameters

- **interval** (qwt.interval.QwtInterval) – Interval
- **stepSize** (*float*) – Step size

Returns
Calculated ticks

buildMinorTicks(*ticks*, *maxMinorSteps*, *stepSize*)

Calculate minor ticks for an interval

Parameters

- **ticks** (*list*) – Major ticks (returned)
- **maxMinorSteps** (*int*) – Maximum number of minor steps
- **stepSize** (*float*) – Step size

align(*interval*, *stepSize*)

Align an interval to a step size

The limits of an interval are aligned that both are integer multiples of the step size.

Parameters

- **interval** (qwt.interval.QwtInterval) – Interval
- **stepSize** (*float*) – Step size

Returns
Aligned interval

5.4.6 QwtLogScaleEngine

class qwt.scale_engine.**QwtLogScaleEngine**(*base=10*)

A scale engine for logarithmic scales

The step size is measured in *decades* and the major step size will be adjusted to fit the pattern {1,2,3,5}.10**n, where n is a natural number including zero.

> **Warning**
>
> The step size as well as the margins are measured in *decades*.

autoScale(*maxNumSteps*, *x1*, *x2*, *stepSize*, *relativeMargin=0.0*)

Align and divide an interval

Parameters

- **maxNumSteps** (*int*) – Max. number of steps
- **x1** (*float*) – First limit of the interval (In/Out)
- **x2** (*float*) – Second limit of the interval (In/Out)
- **stepSize** (*float*) – Step size
- **relativeMargin** (*float*) – Margin as a fraction of the interval width

Returns

tuple (x1, x2, stepSize)

> **See also**
>
> `setAttribute()`

divideScale(*x1*, *x2*, *maxMajorSteps*, *maxMinorSteps*, *stepSize=0.0*)

Calculate a scale division for an interval

Parameters

- **x1** (*float*) – First interval limit
- **x2** (*float*) – Second interval limit
- **maxMajorSteps** (*int*) – Maximum for the number of major steps
- **maxMinorSteps** (*int*) – Maximum number of minor steps
- **stepSize** (*float*) – Step size. If stepSize == 0.0, the scaleEngine calculates one

Returns

Calculated scale division

buildTicks(*interval*, *stepSize*, *maxMinorSteps*)

Calculate ticks for an interval

Parameters

- **interval** (qwt.interval.QwtInterval) – Interval
- **stepSize** (*float*) – Step size
- **maxMinorSteps** (*int*) – Maximum number of minor steps

Returns

Calculated ticks

buildMajorTicks(*interval*, *stepSize*)

Calculate major ticks for an interval

Parameters

- **interval** (qwt.interval.QwtInterval) – Interval
- **stepSize** (*float*) – Step size

Returns
Calculated ticks

buildMinorTicks(*ticks*, *maxMinorSteps*, *stepSize*)

Calculate minor ticks for an interval

Parameters

- **ticks** (*list*) – Major ticks (returned)
- **maxMinorSteps** (*int*) – Maximum number of minor steps
- **stepSize** (*float*) – Step size

align(*interval*, *stepSize*)

Align an interval to a step size

The limits of an interval are aligned that both are integer multiples of the step size.

Parameters

- **interval** (qwt.interval.QwtInterval) – Interval
- **stepSize** (*float*) – Step size

Returns
Aligned interval

5.4.7 QwtAbstractScaleDraw

class qwt.scale_draw.**QwtAbstractScaleDraw**

A abstract base class for drawing scales

QwtAbstractScaleDraw can be used to draw linear or logarithmic scales.

After a scale division has been specified as a *QwtScaleDiv* object using *setScaleDiv()*, the scale can be drawn with the *draw()* member.

Scale components:

- *QwtAbstractScaleDraw.Backbone*: Backbone = the line where the ticks are located
- *QwtAbstractScaleDraw.Ticks*: Ticks
- *QwtAbstractScaleDraw.Labels*: Labels

class QwtAbstractScaleDraw

The range of the scale is initialized to [0, 100], The spacing (distance between ticks and labels) is set to 4, the tick lengths are set to 4,6 and 8 pixels

extent(*font*)

Calculate the extent

The extent is the distance from the baseline to the outermost pixel of the scale draw in opposite to its orientation. It is at least minimumExtent() pixels.

Parameters
font (*QFont*) – Font used for drawing the tick labels

Returns
Number of pixels

> **See also**
>
> *setMinimumExtent()*, *minimumExtent()*

drawTick(*painter*, *value*, *len_*)

Draw a tick

Parameters

- **painter** (*QPainter*) – Painter
- **value** (*float*) – Value of the tick
- **len** (*float*) – Length of the tick

> **See also**
>
> *drawBackbone()*, *drawLabel()*

drawBackbone(*painter*)

Draws the baseline of the scale

Parameters
painter (*QPainter*) – Painter

> **See also**
>
> *drawTick()*, *drawLabel()*

drawLabel(*painter*, *value*)

Draws the label for a major scale tick

Parameters

- **painter** (*QPainter*) – Painter
- **value** (*float*) – Value

> **See also**
>
> *drawTick()*, *drawBackbone()*

enableComponent(*component*, *enable*)

En/Disable a component of the scale

Parameters

- **component** (*int*) – Scale component
- **enable** (*bool*) – On/Off

See also

hasComponent()

hasComponent(*component*)

Check if a component is enabled

Parameters
component (*int*) – Component type

Returns
True, when component is enabled

See also

enableComponent()

setScaleDiv(*scaleDiv*)

Change the scale division

Parameters
scaleDiv (qwt.scale_div.QwtScaleDiv) – New scale division

setTransformation(*transformation*)

Change the transformation of the scale

Parameters
transformation (qwt.transform.QwtTransform) – New scale transformation

scaleMap()

Returns
Map how to translate between scale and pixel values

scaleDiv()

Returns
scale division

setPenWidth(*width*)

Specify the width of the scale pen

Parameters
width (*int*) – Pen width

See also

penWidth()

penWidth()

Returns
Scale pen width

> **See also**
>
> *setPenWidth()*

draw(*painter*, *palette*)

Draw the scale

Parameters

- **painter** (*QPainter*) – The painter
- **palette** (*QPalette*) – Palette, text color is used for the labels, foreground color for ticks and backbone

setSpacing(*spacing*)

Set the spacing between tick and labels

The spacing is the distance between ticks and labels. The default spacing is 4 pixels.

Parameters

spacing (*float*) – Spacing

> **See also**
>
> *spacing()*

spacing()

Get the spacing

The spacing is the distance between ticks and labels. The default spacing is 4 pixels.

Returns

Spacing

> **See also**
>
> *setSpacing()*

setMinimumExtent(*minExtent*)

Set a minimum for the extent

The extent is calculated from the components of the scale draw. In situations, where the labels are changing and the layout depends on the extent (f.e scrolling a scale), setting an upper limit as minimum extent will avoid jumps of the layout.

Parameters

minExtent (*float*) – Minimum extent

> **See also**
>
> *extent()*, *minimumExtent()*

minimumExtent()

Get the minimum extent

Returns
Minimum extent

See also

extent(), *setMinimumExtent()*

setTickLength(*tick_type*, *length*)

Set the length of the ticks

Parameters

- **tick_type** (*int*) – Tick type
- **length** (*float*) – New length

Warning

the length is limited to [0..1000]

tickLength(*tick_type*)

Parameters
tick_type (*int*) – Tick type

Returns
Length of the ticks

See also

setTickLength(), *maxTickLength()*

maxTickLength()

Returns
Length of the longest tick

Useful for layout calculations

See also

tickLength(), *setTickLength()*

setTickLighterFactor(*tick_type*, *factor*)

Set the color lighter factor of the ticks

Parameters

- **tick_type** (*int*) – Tick type
- **factor** (*int*) – New factor

tickLighterFactor(*tick_type*)

Parameters
tick_type (*int*) – Tick type

Returns
Color lighter factor of the ticks

See also

setTickLighterFactor()

label(*value*)

Convert a value into its representing label

The value is converted to a plain text using *QLocale().toString(value)*. This method is often overloaded by applications to have individual labels.

Parameters
value (*float*) – Value

Returns
Label string

tickLabel(*font*, *value*)

Convert a value into its representing label and cache it.

The conversion between value and label is called very often in the layout and painting code. Unfortunately the calculation of the label sizes might be slow (really slow for rich text in Qt4), so it's necessary to cache the labels.

Parameters

- **font** (*QFont*) – Font
- **value** (*float*) – Value

Returns
Tuple (tick label, text size)

invalidateCache()

Invalidate the cache used by *tickLabel()*

The cache is invalidated, when a new *QwtScaleDiv* is set. If the labels need to be changed. while the same *QwtScaleDiv* is set, *invalidateCache()* needs to be called manually.

5.4.8 QwtScaleDraw

class qwt.scale_draw.**QwtScaleDraw**

A class for drawing scales

QwtScaleDraw can be used to draw linear or logarithmic scales. A scale has a position, an alignment and a length, which can be specified . The labels can be rotated and aligned to the ticks using *setLabelRotation()* and *setLabelAlignment()*.

After a scale division has been specified as a QwtScaleDiv object using *QwtAbstractScaleDraw.setScaleDiv(scaleDiv)*, the scale can be drawn with the *QwtAbstractScaleDraw.draw()* member.

Alignment of the scale draw:

- *QwtScaleDraw.BottomScale*: The scale is below
- *QwtScaleDraw.TopScale*: The scale is above
- *QwtScaleDraw.LeftScale*: The scale is left
- *QwtScaleDraw.RightScale*: The scale is right

class QwtScaleDraw

The range of the scale is initialized to [0, 100], The position is at (0, 0) with a length of 100. The orientation is *QwtAbstractScaleDraw.Bottom*.

alignment()

Returns
Alignment of the scale

See also

setAlignment()

setAlignment(*align*)

Set the alignment of the scale

Parameters
align (*int*) – Alignment of the scale

Alignment of the scale draw:

- *QwtScaleDraw.BottomScale*: The scale is below
- *QwtScaleDraw.TopScale*: The scale is above
- *QwtScaleDraw.LeftScale*: The scale is left
- *QwtScaleDraw.RightScale*: The scale is right

The default alignment is *QwtScaleDraw.BottomScale*

See also

alignment()

orientation()

Return the orientation

TopScale, BottomScale are horizontal (*Qt.Horizontal*) scales, LeftScale, RightScale are vertical (*Qt.Vertical*) scales.

Returns
Orientation of the scale

See also

alignment()

`getBorderDistHint`(*font*)

Determine the minimum border distance

This member function returns the minimum space needed to draw the mark labels at the scale's endpoints.

Parameters
font (*QFont*) – Font

Returns
tuple *(start, end)*

Returned tuple:

- start: Start border distance
- end: End border distance

`minLabelDist`(*font*)

Determine the minimum distance between two labels, that is necessary that the texts don't overlap.

Parameters
font (*QFont*) – Font

Returns
The maximum width of a label

See also

getBorderDistHint()

`extent`(*font*)

Calculate the width/height that is needed for a vertical/horizontal scale.

The extent is calculated from the pen width of the backbone, the major tick length, the spacing and the maximum width/height of the labels.

Parameters
font (*QFont*) – Font used for painting the labels

Returns
Extent

See also

minLength()

`minLength`(*font*)

Calculate the minimum length that is needed to draw the scale

Parameters
font (*QFont*) – Font used for painting the labels

Returns
Minimum length that is needed to draw the scale

> **See also**
>
> *extent()*

labelPosition(*value*)

Find the position, where to paint a label

The position has a distance that depends on the length of the ticks in direction of the *alignment()*.

Parameters
value (*float*) – Value

Returns
Position, where to paint a label

drawTick(*painter*, *value*, *len_*)

Draw a tick

Parameters

- **painter** (*QPainter*) – Painter
- **value** (*float*) – Value of the tick
- **len** (*float*) – Length of the tick

> **See also**
>
> *drawBackbone()*, *drawLabel()*

drawBackbone(*painter*)

Draws the baseline of the scale

Parameters
painter (*QPainter*) – Painter

> **See also**
>
> *drawTick()*, *drawLabel()*

move(**args*)

Move the position of the scale

The meaning of the parameter pos depends on the alignment:

- *QwtScaleDraw.LeftScale*:

  The origin is the topmost point of the backbone. The backbone is a vertical line. Scale marks and labels are drawn at the left of the backbone.

- *QwtScaleDraw.RightScale*:

  The origin is the topmost point of the backbone. The backbone is a vertical line. Scale marks and labels are drawn at the right of the backbone.

- *QwtScaleDraw.TopScale*:

The origin is the leftmost point of the backbone. The backbone is a horizontal line. Scale marks and labels are drawn above the backbone.

- *QwtScaleDraw.BottomScale*:

  The origin is the leftmost point of the backbone. The backbone is a horizontal line Scale marks and labels are drawn below the backbone.

move(*x*, *y*)

Parameters
- **x** (*float*) – X coordinate
- **y** (*float*) – Y coordinate

move(*pos*)

Parameters
pos (*QPointF*) – position

See also

pos(), *setLength()*

pos()

Returns
Origin of the scale

See also

pos(), *setLength()*

setLength(*length*)

Set the length of the backbone.

The length doesn't include the space needed for overlapping labels.

Parameters
length (*float*) – Length of the backbone

See also

move(), *minLabelDist()*

length()

Returns
the length of the backbone

See also

setLength(), *pos()*

drawLabel(*painter*, *value*)

Draws the label for a major scale tick

Parameters

- **painter** (*QPainter*) – Painter
- **value** (*float*) – Value

See also

drawTick(), *drawBackbone()*, *boundingLabelRect()*

boundingLabelRect(*font*, *value*)

Find the bounding rectangle for the label.

The coordinates of the rectangle are absolute (calculated from *pos()*) in direction of the tick.

Parameters

- **font** (*QFont*) – Font used for painting
- **value** (*float*) – Value

Returns

Bounding rectangle

See also

labelRect()

labelTransformation(*pos*, *size*)

Calculate the transformation that is needed to paint a label depending on its alignment and rotation.

Parameters

- **pos** (*QPointF*) – Position where to paint the label
- **size** (*QSizeF*) – Size of the label

Returns

Transformation matrix

See also

setLabelAlignment(), *setLabelRotation()*

labelRect(*font*, *value*)

Find the bounding rectangle for the label. The coordinates of the rectangle are relative to spacing + tick length from the backbone in direction of the tick.

Parameters

- **font** (*QFont*) – Font used for painting
- **value** (*float*) – Value

Returns
Bounding rectangle that is needed to draw a label

`labelSize`(*font*, *value*)

Calculate the size that is needed to draw a label

Parameters

- **font** (*QFont*) – Label font
- **value** (*float*) – Value

Returns
Size that is needed to draw a label

`setLabelRotation`(*rotation*)

Rotate all labels.

When changing the rotation, it might be necessary to adjust the label flags too. Finding a useful combination is often the result of try and error.

Parameters
rotation (*float*) – Angle in degrees. When changing the label rotation, the label flags often needs to be adjusted too.

See also

setLabelAlignment(), *labelRotation()*, *labelAlignment()*

`labelRotation`()

Returns
the label rotation

See also

setLabelRotation(), *labelAlignment()*

`setLabelAlignment`(*alignment*)

Change the label flags

Labels are aligned to the point tick length + spacing away from the backbone.

The alignment is relative to the orientation of the label text. In case of an flags of 0 the label will be aligned depending on the orientation of the scale:

- *QwtScaleDraw.TopScale*: *Qt.AlignHCenter* | *Qt.AlignTop*
- *QwtScaleDraw.BottomScale*: *Qt.AlignHCenter* | *Qt.AlignBottom*
- *QwtScaleDraw.LeftScale*: *Qt.AlignLeft* | *Qt.AlignVCenter*
- *QwtScaleDraw.RightScale*: *Qt.AlignRight* | *Qt.AlignVCenter*

Changing the alignment is often necessary for rotated labels.

:param Qt.Alignment alignment Or'd *Qt.AlignmentFlags*

See also

setLabelRotation(), *labelRotation()*, *labelAlignment()*

Warning

The various alignments might be confusing. The alignment of the label is not the alignment of the scale and is not the alignment of the flags (*QwtText.flags()*) returned from *QwtAbstractScaleDraw.label()*.

`labelAlignment`()

Returns
the label flags

See also

setLabelAlignment(), *labelRotation()*

`setLabelAutoSize`(*state*)

Set label automatic size option state

When drawing text labels, if automatic size mode is enabled (default behavior), the axes are drawn in order to optimize layout space and depends on text label individual sizes. Otherwise, width and height won't change when axis range is changing.

This option is not implemented in Qwt C++ library: this may be used either as an optimization (updating plot layout is faster when this option is enabled) or as an appearance preference (with Qwt default behavior, the size of axes may change when zooming and/or panning plot canvas which in some cases may not be desired).

Parameters
state (*bool*) – On/off

See also

labelAutoSize()

`labelAutoSize`()

Returns
True if automatic size option is enabled for labels

See also

setLabelAutoSize()

`maxLabelWidth`(*font*)

Parameters
font (*QFont*) – Font

Returns
the maximum width of a label

`maxLabelHeight`(*font*)

Parameters
font (*QFont*) – Font

Returns
the maximum height of a label

5.5 QwtSymbol

`class qwt.symbol.QwtSymbol`(**args*)

A class for drawing symbols

Symbol styles:

- *QwtSymbol.NoSymbol*: No Style. The symbol cannot be drawn.
- *QwtSymbol.Ellipse*: Ellipse or circle
- *QwtSymbol.Rect*: Rectangle
- *QwtSymbol.Diamond*: Diamond
- *QwtSymbol.Triangle*: Triangle pointing upwards
- *QwtSymbol.DTriangle*: Triangle pointing downwards
- *QwtSymbol.UTriangle*: Triangle pointing upwards
- *QwtSymbol.LTriangle*: Triangle pointing left
- *QwtSymbol.RTriangle*: Triangle pointing right
- *QwtSymbol.Cross*: Cross (+)
- *QwtSymbol.XCross*: Diagonal cross (X)
- *QwtSymbol.HLine*: Horizontal line
- *QwtSymbol.VLine*: Vertical line
- *QwtSymbol.Star1*: X combined with +
- *QwtSymbol.Star2*: Six-pointed star
- *QwtSymbol.Hexagon*: Hexagon
- *QwtSymbol.Path*: The symbol is represented by a painter path, where the origin (0, 0) of the path coordinate system is mapped to the position of the symbol

  ..seealso:

  ```
  :py:meth:`setPath()`, :py:meth:`path()`
  ```

- *QwtSymbol.Pixmap*: The symbol is represented by a pixmap. The pixmap is centered or aligned to its pin point.

  ..seealso:

  ```
  :py:meth:`setPinPoint()`
  ```

- *QwtSymbol.Graphic*: The symbol is represented by a graphic. The graphic is centered or aligned to its pin point.

  ..seealso:

  ```
  :py:meth:`setPinPoint()`
  ```

- *QwtSymbol.SvgDocument*: The symbol is represented by a SVG graphic. The graphic is centered or aligned to its pin point.

  ..seealso:

  ```
  :py:meth:`setPinPoint()`
  ```

- *QwtSymbol.UserStyle*: Styles >= *QwtSymbol.UserStyle* are reserved for derived classes of *QwtSymbol* that overload *drawSymbols()* with additional application specific symbol types.

Cache policies:

Depending on the render engine and the complexity of the symbol shape it might be faster to render the symbol to a pixmap and to paint this pixmap.

F.e. the raster paint engine is a pure software renderer where in cache mode a draw operation usually ends in raster operation with the the backing store, that are usually faster, than the algorithms for rendering polygons. But the opposite can be expected for graphic pipelines that can make use of hardware acceleration.

The default setting is AutoCache

..seealso:

```
:py:meth:`setCachePolicy()`, :py:meth:`cachePolicy()`
```

Note

The policy has no effect, when the symbol is painted to a vector graphics format (PDF, SVG).

Warning

Since Qt 4.8 raster is the default backend on X11

Valid cache policies:

- *QwtSymbol.NoCache*: Don't use a pixmap cache
- *QwtSymbol.Cache*: Always use a pixmap cache
- *QwtSymbol.AutoCache*: Use a cache when the symbol is rendered with the software renderer (*QPaintEngine.Raster*)

class QwtSymbol([*style=QwtSymbol.NoSymbol*])

The symbol is constructed with gray interior, black outline with zero width, no size and style 'NoSymbol'.

Parameters

style (*int*) – Symbol Style

class QwtSymbol(*style*, *brush*, *pen*, *size*)

Parameters

- **style** (*int*) – Symbol Style
- **brush** (*QBrush*) – Brush to fill the interior
- **pen** (*QPen*) – Outline pen
- **size** (*QSize*) – Size

class QwtSymbol(*path*, *brush*, *pen*)

Parameters

- **path** (*QPainterPath*) – Painter path
- **brush** (*QBrush*) – Brush to fill the interior
- **pen** (*QPen*) – Outline pen

See also

setPath(), *setBrush()*, *setPen()*, *setSize()*

Style

alias of `int`

classmethod make(*style=None*, *brush=None*, *pen=None*, *size=None*, *path=None*, *pixmap=None*, *graphic=None*, *svgdocument=None*, *pinpoint=None*)

Create and setup a new *QwtSymbol* object (convenience function).

Parameters

- **style** (*int or None*) – Symbol Style
- **brush** (*QBrush or None*) – Brush to fill the interior
- **pen** (*QPen or None*) – Outline pen
- **size** (*QSize or None*) – Size
- **path** (*QPainterPath or None*) – Painter path
- **path** – Painter path
- **pixmap** (*QPixmap or None*) – Pixmap as symbol
- **graphic** (*qwt.graphic.QwtGraphic or None*) – Graphic
- **svgdocument** – SVG icon as symbol

See also

setPixmap(), *setGraphic()*, *setPath()*

setCachePolicy(*policy*)

Change the cache policy

The default policy is AutoCache

Parameters
policy (*int*) – Cache policy

See also
cachePolicy()

cachePolicy()

Returns
Cache policy

See also
setCachePolicy()

setPath(*path*)

Set a painter path as symbol

The symbol is represented by a painter path, where the origin (0, 0) of the path coordinate system is mapped to the position of the symbol.

When the symbol has valid size the painter path gets scaled to fit into the size. Otherwise the symbol size depends on the bounding rectangle of the path.

The following code defines a symbol drawing an arrow:

```
from qtpy.QtGui import QApplication, QPen, QPainterPath, QTransform
from qtpy.QtCore import Qt, QPointF
from qwt import QwtPlot, QwtPlotCurve, QwtSymbol
import numpy as np

app = QApplication([])

# --- Construct custom symbol ---

path = QPainterPath()
path.moveTo(0, 8)
path.lineTo(0, 5)
path.lineTo(-3, 5)
path.lineTo(0, 0)
path.lineTo(3, 5)
path.lineTo(0, 5)

transform = QTransform()
transform.rotate(-30.0)
path = transform.map(path)

pen = QPen(Qt.black, 2 );
pen.setJoinStyle(Qt.MiterJoin)

symbol = QwtSymbol()
symbol.setPen(pen)
```

(continues on next page)

(continued from previous page)

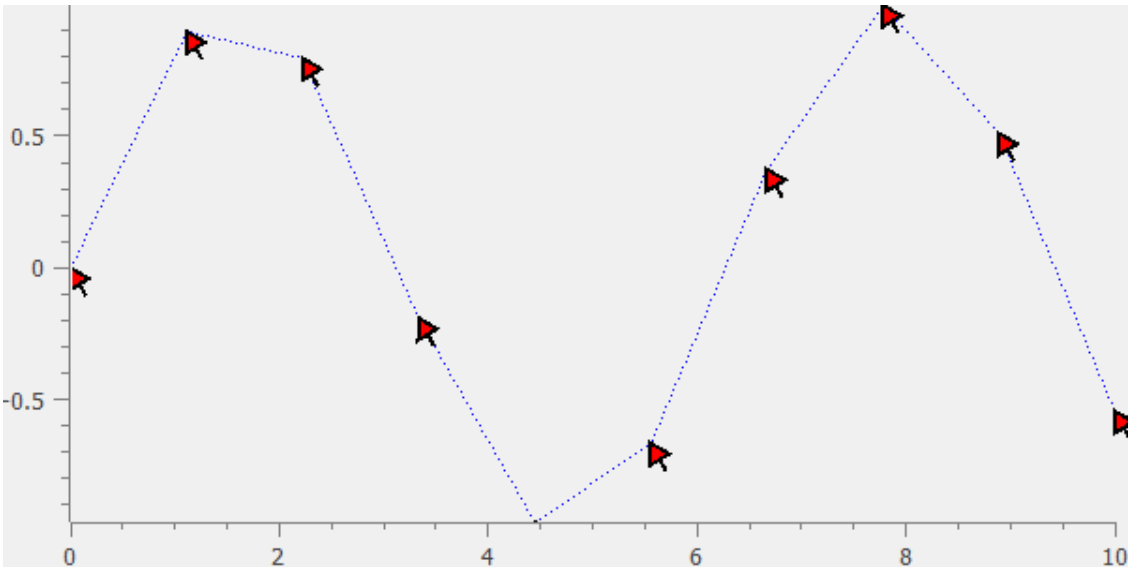
```
symbol.setBrush(Qt.red)
symbol.setPath(path)
symbol.setPinPoint(QPointF(0., 0.))
symbol.setSize(10, 14)

# --- Test it within a simple plot ---

curve = QwtPlotCurve()
curve_pen = QPen(Qt.blue)
curve_pen.setStyle(Qt.DotLine)
curve.setPen(curve_pen)
curve.setSymbol(symbol)
x = np.linspace(0, 10, 10)
curve.setData(x, np.sin(x))

plot = QwtPlot()
curve.attach(plot)
plot.resize(600, 300)
plot.replot()
plot.show()

app.exec_()
```



Parameters

path (*QPainterPath*) – Painter path

See also

path(), *setSize()*

path()

Returns

Painter path for displaying the symbol

See also

setPath()

setPixmap(*pixmap*)

Set a pixmap as symbol

Parameters
pixmap (*QPixmap*) – Pixmap

See also

pixmap(), *setGraphic()*

Note

The *style()* is set to *QwtSymbol.Pixmap*

Note

brush() and *pen()* have no effect

pixmap()

Returns
Assigned pixmap

See also

setPixmap()

setGraphic(*graphic*)

Set a graphic as symbol

Parameters
graphic (qwt.graphic.QwtGraphic) – Graphic

See also

graphic(), *setPixmap()*

Note

The *style()* is set to *QwtSymbol.Graphic*

> **Note**
>
> *brush()* and *pen()* have no effect

`graphic`()

Returns
Assigned graphic

> **See also**
>
> *setGraphic()*

`setSvgDocument`(*svgDocument*)

Set a SVG icon as symbol

Parameters
svgDocument – SVG icon

> **See also**
>
> *setGraphic()*, *setPixmap()*

> **Note**
>
> The *style()* is set to *QwtSymbol.SvgDocument*

> **Note**
>
> *brush()* and *pen()* have no effect

`setSize`(**args*)

Specify the symbol's size

`setSize`(*width*[, *height=-1*])

Parameters
- **width** (*int*) – Width
- **height** (*int*) – Height

`setSize`(*size*)

Parameters
size (*QSize*) – Size

> **See also**
>
> *size()*

size()

Returns
Size

See also

setSize()

setBrush(*brush*)

Assign a brush

The brush is used to draw the interior of the symbol.

Parameters
brush (*QBrush*) – Brush

See also

brush()

brush()

Returns
Brush

See also

setBrush()

setPen(**args*)

Build and/or assign a pen, depending on the arguments.

setPen(*color*, *width*, *style*)

Build and assign a pen

In Qt5 the default pen width is 1.0 (0.0 in Qt4) what makes it non cosmetic (see *QPen.isCosmetic()*). This method signature has been introduced to hide this incompatibility.

Parameters
- **color** (*QColor*) – Pen color
- **width** (*float*) – Pen width
- **style** (*Qt.PenStyle*) – Pen style

setPen(*pen*)

Assign a pen

Parameters
pen (*QPen*) – New pen

See also

pen(), *brush()*

pen()

Returns
Pen

See also

setPen(), *brush()*

setColor(*color*)

Set the color of the symbol

Change the color of the brush for symbol types with a filled area. For all other symbol types the color will be assigned to the pen.

Parameters
color (*QColor*) – Color

See also

setPen(), *setBrush()*, *brush()*, *pen()*

setPinPoint(*pos*, *enable=True*)

Set and enable a pin point

The position of a complex symbol is not always aligned to its center (f.e an arrow, where the peak points to a position). The pin point defines the position inside of a Pixmap, Graphic, SvgDocument or PainterPath symbol where the represented point has to be aligned to.

Parameters
pos (*QPointF*) – Position

Enable bool enable
En/Disable the pin point alignment

See also

pinPoint(), *setPinPointEnabled()*

pinPoint()

Returns
Pin point

See also

setPinPoint(), *setPinPointEnabled()*

setPinPointEnabled(*on*)

En/Disable the pin point alignment

Parameters
on (*bool*) – Enabled, when on is true

> **See also**
>
> *setPinPoint()*, *isPinPointEnabled()*

isPinPointEnabled()

Returns
True, when the pin point translation is enabled

> **See also**
>
> *setPinPoint()*, *setPinPointEnabled()*

drawSymbols(*painter*, *points*)

Render an array of symbols

Painting several symbols is more effective than drawing symbols one by one, as a couple of layout calculations and setting of pen/brush can be done once for the complete array.

Parameters

- **painter** (*QPainter*) – Painter
- **points** (*QPolygonF*) – Positions of the symbols in screen coordinates

drawSymbol(*painter*, *point_or_rect*)

Draw the symbol into a rectangle

The symbol is painted centered and scaled into the target rectangle. It is always painted uncached and the pin point is ignored.

This method is primarily intended for drawing a symbol to the legend.

Parameters

- **painter** (*QPainter*) – Painter
- **point_or_rect** (*QPointF or QPoint or QRectF*) – Position or target rectangle of the symbol in screen coordinates

renderSymbols(*painter*, *points*)

Render the symbol to series of points

Parameters

- **painter** (*QPainter*) – Painter
- **point_or_rect** – Positions of the symbols

boundingRect()

Calculate the bounding rectangle for a symbol at position (0,0).

Returns
Bounding rectangle

invalidateCache()

Invalidate the cached symbol pixmap

The symbol invalidates its cache, whenever an attribute is changed that has an effect ob how to display a symbol. In case of derived classes with individual styles (>= *QwtSymbol.UserStyle*) it might be necessary to call invalidateCache() for attributes that are relevant for this style.

See also

setCachePolicy(), *drawSymbols()*

setStyle(*style*)

Specify the symbol style

Parameters
style (*int*) – Style

See also

style()

style()

Returns
Current symbol style

See also

setStyle()

5.6 Text widgets

5.6.1 QwtText

class qwt.text.**QwtText**(*text=None*, *textFormat=None*, *other=None*)

A class representing a text

A *QwtText* is a text including a set of attributes how to render it.

- Format:

A text might include control sequences (f.e tags) describing how to render it. Each format (f.e MathML, TeX, Qt Rich Text) has its own set of control sequences, that can be handles by a special *QwtTextEngine* for this format.

- Background:

A text might have a background, defined by a *QPen* and *QBrush* to improve its visibility. The corners of the background might be rounded.

- Font:

A text might have an individual font.

- Color

A text might have an individual color.

- Render Flags

Flags from *Qt.AlignmentFlag* and *Qt.TextFlag* used like in *QPainter.drawText()*.

..seealso:

```
:py:meth:`qwt.text.QwtTextEngine`,
:py:meth:`qwt.text.QwtTextLabel`
```

Text formats:

- *QwtText.AutoText*:

  The text format is determined using *QwtTextEngine.mightRender()* for all available text engines in increasing order > PlainText. If none of the text engines can render the text is rendered like *QwtText.PlainText*.

- *QwtText.PlainText*:

  Draw the text as it is, using a QwtPlainTextEngine.

- *QwtText.RichText*:

  Use the Scribe framework (Qt Rich Text) to render the text.

- *QwtText.OtherFormat*:

  The number of text formats can be extended using *setTextEngine*. Formats >= *QwtText.OtherFormat* are not used by Qwt.

Paint attributes:

- *QwtText.PaintUsingTextFont*: The text has an individual font.
- *QwtText.PaintUsingTextColor*: The text has an individual color.
- *QwtText.PaintBackground*: The text has an individual background.

Layout attributes:

- *QwtText.MinimumLayout*:

  Layout the text without its margins. This mode is useful if a text needs to be aligned accurately, like the tick labels of a scale. If *QwtTextEngine.textMargins* is not implemented for the format of the text, *MinimumLayout* has no effect.

class QwtText([*text=None*][, *textFormat=None*][, *other=None*])

Parameters

- **text** (*str*) – Text content
- **textFormat** (*int*) – Text format
- **other** (qwt.text.QwtText) – Object to copy (text and textFormat arguments are ignored)

classmethod make(*text=None*, *textformat=None*, *renderflags=None*, *font=None*, *family=None*, *pointsize=None*, *weight=None*, *color=None*, *borderradius=None*, *borderpen=None*, *brush=None*)

Create and setup a new *QwtText* object (convenience function).

Parameters

- **text** (*str*) – Text content
- **textformat** (*int*) – Text format
- **renderflags** (*int*) – Flags from *Qt.AlignmentFlag* and *Qt.TextFlag*

- **font** (*QFont or None*) – Font
- **family** (*str or None*) – Font family (default: Helvetica)
- **pointsize** (*int or None*) – Font point size (default: 10)
- **weight** (*int or None*) – Font weight (default: QFont.Normal)
- **color** (*QColor or str or None*) – Pen color
- **borderradius** (*float or None*) – Radius for the corners of the border frame
- **borderpen** (*QPen or None*) – Background pen
- **brush** (*QBrush or None*) – Background brush

See also

setText()

isEmpty()

Returns
True if text is empty

setText(*text*, *textFormat=None*)

Assign a new text content

Parameters

- **text** (*str*) – Text content
- **textFormat** (*int*) – Text format

See also

text()

text()

Returns
Text content

See also

setText()

setRenderFlags(*renderFlags*)

Change the render flags

The default setting is *Qt.AlignCenter*

Parameters
renderFlags (*int*) – Bitwise OR of the flags used like in *QPainter.drawText()*

See also

renderFlags(), *qwt.text.QwtTextEngine.draw()*

renderFlags()

Returns
Render flags

See also

setRenderFlags()

setFont(*font*)

Set the font.

Parameters
font (*QFont*) – Font

Note

Setting the font might have no effect, when the text contains control sequences for setting fonts.

See also

font(), *usedFont()*

font()

Returns
Return the font

See also

setFont(), *usedFont()*

usedFont(*defaultFont*)

Return the font of the text, if it has one. Otherwise return defaultFont.

Parameters
defaultFont (*QFont*) – Default font

Returns
Font used for drawing the text

See also

setFont(), *font()*

setColor(*color*)

Set the pen color used for drawing the text.

Parameters
color (*QColor*) – Color

Note

Setting the color might have no effect, when the text contains control sequences for setting colors.

See also

color(), *usedColor()*

color()

Returns
Return the pen color, used for painting the text

See also

setColor(), *usedColor()*

usedColor(*defaultColor*)

Return the color of the text, if it has one. Otherwise return defaultColor.

Parameters
defaultColor (*QColor*) – Default color

Returns
Color used for drawing the text

See also

setColor(), *color()*

setBorderRadius(*radius*)

Set the radius for the corners of the border frame

Parameters
radius (*float*) – Radius of a rounded corner

See also

borderRadius(), *setBorderPen()*, *setBackgroundBrush()*

borderRadius()

Returns
Radius for the corners of the border frame

See also

setBorderRadius(), *borderPen()*, *backgroundBrush()*

setBorderPen(*pen*)

Set the background pen

Parameters

pen (*QPen*) – Background pen

See also

borderPen(), *setBackgroundBrush()*

borderPen()

Returns

Background pen

See also

setBorderPen(), *backgroundBrush()*

setBackgroundBrush(*brush*)

Set the background brush

Parameters

brush (*QBrush*) – Background brush

See also

backgroundBrush(), *setBorderPen()*

backgroundBrush()

Returns

Background brush

See also

setBackgroundBrush(), *borderPen()*

setPaintAttribute(*attribute*, *on=True*)

Change a paint attribute

Parameters

- **attribute** (*int*) – Paint attribute
- **on** (*bool*) – On/Off

Note

Used by *setFont()*, *setColor()*, *setBorderPen()* and *setBackgroundBrush()*

See also

testPaintAttribute()

testPaintAttribute(*attribute*)

Test a paint attribute

Parameters
attribute (*int*) – Paint attribute

Returns
True, if attribute is enabled

See also

setPaintAttribute()

setLayoutAttribute(*attribute*, *on=True*)

Change a layout attribute

Parameters

- **attribute** (*int*) – Layout attribute
- **on** (*bool*) – On/Off

See also

testLayoutAttribute()

testLayoutAttribute(*attribute*)

Test a layout attribute

Parameters
attribute (*int*) – Layout attribute

Returns
True, if attribute is enabled

See also

setLayoutAttribute()

heightForWidth(*width*, *defaultFont=None*)

Find the height for a given width

Parameters

- **width** (*float*) – Width
- **defaultFont** (*QFont*) – Font, used for the calculation if the text has no font

Returns
Calculated height

textSize(*defaultFont*)

Returns the size, that is needed to render text

:param QFont defaultFont Font, used for the calculation if the text has no font :return: Caluclated size

draw(*painter*, *rect*)

Draw a text into a rectangle

Parameters

- **painter** (*QPainter*) – Painter
- **rect** (*QRectF*) – Rectangle

textEngine(*text=None*, *format_=None*)

Find the text engine for a text format

In case of *QwtText.AutoText* the first text engine (beside *QwtPlainTextEngine*) is returned, where *QwtTextEngine.mightRender* returns true. If there is none *QwtPlainTextEngine* is returned.

If no text engine is registered for the format *QwtPlainTextEngine* is returned.

Parameters

- **text** (*str*) – Text, needed in case of AutoText
- **format** (*int*) – Text format

Returns
Corresponding text engine

setTextEngine(*format_*, *engine*)

Assign/Replace a text engine for a text format

With setTextEngine it is possible to extend *PythonQwt* with other types of text formats.

For *QwtText.PlainText* it is not allowed to assign a engine to None.

Parameters

- **format** (*int*) – Text format
- **engine** (qwt.text.QwtTextEngine) – Text engine

See also

setPaintAttribute()

Warning

Using *QwtText.AutoText* does nothing.

5.6.2 QwtTextLabel

class qwt.text.**QwtTextLabel**(**args*)

A Widget which displays a QwtText

class QwtTextLabel(*parent*)

Parameters
parent (*QWidget*) – Parent widget

class QwtTextLabel([*text=None*][, *parent=None*])

Parameters

- **text** (*str*) – Text
- **parent** (*QWidget*) – Parent widget

setPlainText(*text*)

Interface for the designer plugin - does the same as setText()

Parameters
text (*str*) – Text

See also

plainText()

plainText()

Interface for the designer plugin

Returns
Text as plain text

See also

setPlainText()

setText(*text*, *textFormat=0*)

Change the label's text, keeping all other QwtText attributes

Parameters

- **text** (qwt.text.QwtText *or* *str*) – New text
- **textFormat** (*int*) – Format of text

See also

text()

text()

Returns
Return the text

> **See also**
>
> *setText()*

clear()

Clear the text and all *QwtText* attributes

indent()

Returns
Label's text indent in pixels

> **See also**
>
> *setIndent()*

setIndent(*indent*)

Set label's text indent in pixels

Parameters
indent (*int*) – Indentation in pixels

> **See also**
>
> *indent()*

margin()

Returns
Label's text indent in pixels

> **See also**
>
> *setMargin()*

setMargin(*margin*)

Set label's margin in pixels

Parameters
margin (*int*) – Margin in pixels

> **See also**
>
> *margin()*

sizeHint()

Return a size hint

minimumSizeHint()

Return a minimum size hint

heightForWidth(*width*)

Parameters
width (*int*) – Width

Returns
Preferred height for this widget, given the width.

paintEvent(*self*, *a0: QPaintEvent | None*)

drawContents(*painter*)

Redraw the text and focus indicator

Parameters
painter (*QPainter*) – Painter

drawText(*painter*, *textRect*)

Redraw the text

Parameters

- **painter** (*QPainter*) – Painter
- **textRect** (*QRectF*) – Text rectangle

textRect()

Calculate geometry for the text in widget coordinates

Returns
Geometry for the text

5.7 Text engines

5.7.1 QwtTextEngine

class qwt.text.**QwtTextEngine**

Abstract base class for rendering text strings

A text engine is responsible for rendering texts for a specific text format. They are used by *QwtText* to render a text.

QwtPlainTextEngine and *QwtRichTextEngine* are part of the *PythonQwt* library.

See also

qwt.text.QwtText.setTextEngine()

heightForWidth(*font*, *flags*, *text*, *width*)

Find the height for a given width

Parameters

- **font** (*QFont*) – Font of the text
- **flags** (*int*) – Bitwise OR of the flags used like in QPainter::drawText
- **text** (*str*) – Text to be rendered
- **width** (*float*) – Width

Returns
Calculated height

textSize(*font*, *flags*, *text*)

Returns the size, that is needed to render text

Parameters

- **font** (*QFont*) – Font of the text
- **flags** (*int*) – Bitwise OR of the flags like in for QPainter::drawText
- **text** (*str*) – Text to be rendered

Returns
Calculated size

mightRender(*text*)

Test if a string can be rendered by this text engine

Parameters
text (*str*) – Text to be tested

Returns
True, if it can be rendered

textMargins(*font*)

Return margins around the texts

The textSize might include margins around the text, like QFontMetrics::descent(). In situations where texts need to be aligned in detail, knowing these margins might improve the layout calculations.

Parameters
font (*QFont*) – Font of the text

Returns
tuple (left, right, top, bottom) representing margins

draw(*painter*, *rect*, *flags*, *text*)

Draw the text in a clipping rectangle

Parameters

- **painter** (*QPainter*) – Painter
- **rect** (*QRectF*) – Clipping rectangle
- **flags** (*int*) – Bitwise OR of the flags like in for QPainter::drawText()
- **text** (*str*) – Text to be rendered

5.7.2 QwtPlainTextEngine

class qwt.text.**QwtPlainTextEngine**

A text engine for plain texts

QwtPlainTextEngine renders texts using the basic *Qt* classes *QPainter* and *QFontMetrics*.

heightForWidth(*font*, *flags*, *text*, *width*)

Find the height for a given width

Parameters

- **font** (*QFont*) – Font of the text

- **flags** (*int*) – Bitwise OR of the flags used like in QPainter::drawText
- **text** (*str*) – Text to be rendered
- **width** (*float*) – Width

Returns
Calculated height

textSize(*font*, *flags*, *text*)

Returns the size, that is needed to render text

Parameters

- **font** (*QFont*) – Font of the text
- **flags** (*int*) – Bitwise OR of the flags like in for QPainter::drawText
- **text** (*str*) – Text to be rendered

Returns
Calculated size

textMargins(*font*)

Return margins around the texts

The textSize might include margins around the text, like QFontMetrics::descent(). In situations where texts need to be aligned in detail, knowing these margins might improve the layout calculations.

Parameters
font (*QFont*) – Font of the text

Returns
tuple (left, right, top, bottom) representing margins

draw(*painter*, *rect*, *flags*, *text*)

Draw the text in a clipping rectangle

Parameters

- **painter** (*QPainter*) – Painter
- **rect** (*QRectF*) – Clipping rectangle
- **flags** (*int*) – Bitwise OR of the flags like in for QPainter::drawText()
- **text** (*str*) – Text to be rendered

mightRender(*text*)

Test if a string can be rendered by this text engine

Parameters
text (*str*) – Text to be tested

Returns
True, if it can be rendered

5.7.3 QwtRichTextEngine

class qwt.text.**QwtRichTextEngine**

A text engine for *Qt* rich texts

QwtRichTextEngine renders *Qt* rich texts using the classes of the Scribe framework of *Qt*.

heightForWidth(*font*, *flags*, *text*, *width*)

Find the height for a given width

Parameters

- **font** (*QFont*) – Font of the text
- **flags** (*int*) – Bitwise OR of the flags used like in QPainter::drawText
- **text** (*str*) – Text to be rendered
- **width** (*float*) – Width

Returns
Calculated height

textSize(*font*, *flags*, *text*)

Returns the size, that is needed to render text

Parameters

- **font** (*QFont*) – Font of the text
- **flags** (*int*) – Bitwise OR of the flags like in for QPainter::drawText
- **text** (*str*) – Text to be rendered

Returns
Calculated size

draw(*painter*, *rect*, *flags*, *text*)

Draw the text in a clipping rectangle

Parameters

- **painter** (*QPainter*) – Painter
- **rect** (*QRectF*) – Clipping rectangle
- **flags** (*int*) – Bitwise OR of the flags like in for QPainter::drawText()
- **text** (*str*) – Text to be rendered

mightRender(*text*)

Test if a string can be rendered by this text engine

Parameters
text (*str*) – Text to be tested

Returns
True, if it can be rendered

textMargins(*font*)

Return margins around the texts

The textSize might include margins around the text, like QFontMetrics::descent(). In situations where texts need to be aligned in detail, knowing these margins might improve the layout calculations.

Parameters
font (*QFont*) – Font of the text

Returns
tuple (left, right, top, bottom) representing margins

5.8 NumPy array to QImage

qwt.toqimage.**array_to_qimage**(*arr*, *copy=False*)

Convert NumPy array to QImage object

Parameters

- **arr** (*numpy.array*) – NumPy array
- **copy** (*bool*) – if True, make a copy of the array

Returns

QImage object

5.9 Qt Designer

PythonQwt ships a Qt Designer plugin which makes a 2D plotting widget (*qwt.qtdesigner.QwtPlotWidget*, a thin `qwt.QwtPlot` subclass) available directly inside Qt Designer's widget box, in the "PythonQwt" group.

5.9.1 Installing the plugin

The plugin file `qwtplugin.py` lives in the `qtdesigner` directory at the root of the PythonQwt source tree. To make it available in Qt Designer, add that directory to the `PYQTDESIGNERPATH` environment variable before starting Qt Designer:

```
# Linux/macOS
export PYQTDESIGNERPATH=<path to PythonQwt>/qtdesigner
designer
```

```
rem Windows
set PYQTDESIGNERPATH=<path to PythonQwt>\qtdesigner
designer
```

Note

Qt Designer custom widget plugins require PyQt5 or PyQt6. PySide6 does not expose `QPyDesignerCustomWidgetPlugin`.

5.9.2 Loading a `.ui` file at runtime

The *qwt.qtdesigner* module provides helper functions to load or compile `.ui` files embedding *qwt.qtdesigner.QwtPlotWidget* widgets:

```
from qwt.qtdesigner import loadui

FormClass = loadui("myform.ui")
form = FormClass()
form.plotwidget.setTitle("Loaded from Qt Designer")
```

5.9.3 Reference

Qt Designer

The *qwt.qtdesigner* module provides helpers to integrate *qwt* widgets into Qt Designer:

- *QwtPlotWidget*
- *loadui()*
- *compileui()*
- *create_qtdesigner_plugin()*

QwtPlotWidget is a thin `qwt.QwtPlot` subclass exposing the standard Qt widget constructor (`__init__(self, parent=None)`). It is the widget promoted by the Qt Designer plugin, so that the code generated by `uic` (e.g. `QwtPlotWidget(parent=...)` with PyQt6) instantiates it correctly. `qwt.QwtPlot` itself keeps its historical constructor.

> **Note**
>
> Qt Designer custom widget plugins rely on `QtDesigner.QPyDesignerCustomWidgetPlugin`, which is only available with PyQt5/PyQt6. PySide6 does not expose this class.

class qwt.qtdesigner.**QwtPlotWidget**(*parent=None*)

`qwt.QwtPlot` widget with the standard Qt constructor.

This subclass is meant to be promoted in Qt Designer: unlike `qwt.QwtPlot` (whose constructor accepts the historical `QwtPlot([title], [parent])` overloads), it exposes the conventional `__init__(self, parent=None)` signature expected by the code generated by `uic` (notably PyQt6, which uses `QwtPlotWidget(parent=...)`).

Args:
parent: Parent widget

qwt.qtdesigner.**loadui**(*fname: str*, *replace_class: str | None = None*)

Return Widget or Window class from a Qt Designer `.ui` file.

When a promoted widget inherits from a class that is not known to the `uic` parser (i.e. not a standard Qt widget), `loadUiType` fails to resolve the widget hierarchy. Passing the offending base class name as `replace_class` neutralizes it by substituting `QFrame` (the base class of `qwt.QwtPlot`) before the file is parsed.

For a plain `qwt.QwtPlot` widget (which already inherits from `QFrame`), no replacement is required and `replace_class` can be left to `None`.

Args:
fname: Path to the `.ui` file replace_class: Base class name to replace by `QFrame`, or `None`

to load the file unchanged

Returns:
The generated form class

qwt.qtdesigner.**compileui**(*fname: str*, *replace_class: str | None = None*) → None

Compile a Qt Designer `.ui` file into a Python module.

Args:
fname: Path to the `.ui` file replace_class: Base class name to replace by `QFrame`, or `None`

to compile the file unchanged

qwt.qtdesigner.**create_qtdesigner_plugin**(*group: str*, *module_name: str*, *class_name: str*, *icon: str | QIcon | None = None*, *tooltip: str = ''*, *whatsthis: str = ''*)

Return a custom Qt Designer plugin class.

Args:

group: Name of the group the widget belongs to in Qt Designer module_name: Name of the module where the widget class is defined class_name: Name of the widget class icon: Icon shown in Qt Designer (path to an image file or

`QtGui.QIcon` instance)

tooltip: Tool tip shown in Qt Designer whatsthis: "What's this" help text shown in Qt Designer

Returns:

A `QtDesigner.QPyDesignerCustomWidgetPlugin` subclass

Example:

```
Plugin = create_qtdesigner_plugin(
    group="PythonQwt",
    module_name="qwt.qtdesigner",
    class_name="QwtPlotWidget",
)
```

Private API:

5.10 QwtGraphic

class qwt.graphic.**QwtGraphic**(**args*)

A paint device for scalable graphics

QwtGraphic is the representation of a graphic that is tailored for scalability. Like *QPicture* it will be initialized by *QPainter* operations and can be replayed later to any target paint device.

While the usual image representations *QImage* and *QPixmap* are not scalable *Qt* offers two paint devices, that might be candidates for representing a vector graphic:

- *QPicture*:

  Unfortunately *QPicture* had been forgotten, when Qt4 introduced floating point based render engines. Its API is still on integers, what make it unusable for proper scaling.

- *QSvgRenderer*, *QSvgGenerator*:

  Unfortunately *QSvgRenderer* hides to much information about its nodes in internal APIs, that are necessary for proper layout calculations. Also it is derived from *QObject* and can't be copied like *QImage*/*QPixmap*.

QwtGraphic maps all scalable drawing primitives to a *QPainterPath* and stores them together with the painter state changes (pen, brush, transformation ...) in a list of *QwtPaintCommands*. For being a complete *QPaintDevice* it also stores pixmaps or images, what is somehow against the idea of the class, because these objects can't be scaled without a loss in quality.

The main issue about scaling a *QwtGraphic* object are the pens used for drawing the outlines of the painter paths. While non cosmetic pens (*QPen.isCosmetic()*) are scaled with the same ratio as the path, cosmetic pens have a fixed width. A graphic might have paths with different pens - cosmetic and non-cosmetic.

QwtGraphic caches 2 different rectangles:

- control point rectangle:

The control point rectangle is the bounding rectangle of all control point rectangles of the painter paths, or the target rectangle of the pixmaps/images.

- bounding rectangle:

  The bounding rectangle extends the control point rectangle by what is needed for rendering the outline with an unscaled pen.

Because the offset for drawing the outline depends on the shape of the painter path (the peak of a triangle is different than the flat side) scaling with a fixed aspect ratio always needs to be calculated from the control point rectangle.

class QwtGraphic

Initializes a null graphic

class QwtGraphic(*other*)

Copy constructor

Parameters
other (qwt.graphic.QwtGraphic) – Source

reset()

Clear all stored commands

isNull()

Return True, when no painter commands have been stored

isEmpty()

Return True, when the bounding rectangle is empty

setRenderHint(*hint*, *on=True*)

Toggle an render hint

testRenderHint(*hint*)

Test a render hint

boundingRect()

The bounding rectangle is the *controlPointRect()* extended by the areas needed for rendering the outlines with unscaled pens.

Returns
Bounding rectangle of the graphic

See also

controlPointRect(), *scaledBoundingRect()*

controlPointRect()

The control point rectangle is the bounding rectangle of all control points of the paths and the target rectangles of the images/pixmaps.

Returns
Control point rectangle

See also

boundingRect(), *scaledBoundingRect()*

`scaledBoundingRect`(*sx*, *sy*)

Calculate the target rectangle for scaling the graphic

Parameters

- **sx** (*float*) – Horizontal scaling factor
- **sy** (*float*) – Vertical scaling factor

Returns

Scaled bounding rectangle

Note

In case of paths that are painted with a cosmetic pen (see `QPen.isCosmetic()`) the target rectangle is different to multiplying the bounding rectangle.

See also

boundingRect(), *controlPointRect()*

`sizeMetrics`()

Return Ceiled *defaultSize()*

`setDefaultSize`(*size*)

The default size is used in all methods rendering the graphic, where no size is explicitly specified. Assigning an empty size means, that the default size will be calculated from the bounding rectangle.

Parameters

size (*QSizeF*) – Default size

See also

defaultSize(), *boundingRect()*

`defaultSize`()

When a non empty size has been assigned by setDefaultSize() this size will be returned. Otherwise the default size is the size of the bounding rectangle.

The default size is used in all methods rendering the graphic, where no size is explicitly specified.

Returns

Default size

See also

setDefaultSize(), *boundingRect()*

render(**args*)

render(*painter*)

Replay all recorded painter commands

Parameters
painter (*QPainter*) – Qt painter

render(*painter*, *size*, *aspectRatioMode*)

Replay all recorded painter commands

The graphic is scaled to fit into the rectangle of the given size starting at (0, 0).

Parameters
- **painter** (*QPainter*) – Qt painter
- **size** (*QSizeF*) – Size for the scaled graphic
- **aspectRatioMode** (*Qt.AspectRatioMode*) – Mode how to scale

render(*painter*, *rect*, *aspectRatioMode*)

Replay all recorded painter commands

The graphic is scaled to fit into the given rectangle

Parameters
- **painter** (*QPainter*) – Qt painter
- **rect** (*QRectF*) – Rectangle for the scaled graphic
- **aspectRatioMode** (*Qt.AspectRatioMode*) – Mode how to scale

render(*painter*, *pos*, *aspectRatioMode*)

Replay all recorded painter commands

The graphic is scaled to the *defaultSize()* and aligned to a position.

Parameters
- **painter** (*QPainter*) – Qt painter
- **pos** (*QPointF*) – Reference point, where to render
- **aspectRatioMode** (*Qt.AspectRatioMode*) – Mode how to scale

toPixmap(**args*)

Convert the graphic to a *QPixmap*

All pixels of the pixmap get initialized by *Qt.transparent* before the graphic is scaled and rendered on it.

The size of the pixmap is the default size (ceiled to integers) of the graphic.

Returns
The graphic as pixmap in default size

See also

defaultSize(), *toImage()*, *render()*

toImage(**args*)

toImage()

Convert the graphic to a *QImage*

All pixels of the image get initialized by 0 (transparent) before the graphic is scaled and rendered on it.

The format of the image is *QImage.Format_ARGB32_Premultiplied*.

The size of the image is the default size (ceiled to integers) of the graphic.

Returns
The graphic as image in default size

toImage(*size*[, *aspectRatioMode=Qt.IgnoreAspectRatio*])
Convert the graphic to a *QImage*

All pixels of the image get initialized by 0 (transparent) before the graphic is scaled and rendered on it.

The format of the image is *QImage.Format_ARGB32_Premultiplied*.

Parameters
- **size** (*QSize*) – Size of the image
- **aspectRatioMode** (*Qt.AspectRatioMode*) – Aspect ratio how to scale the graphic

Returns
The graphic as image

See also
toPixmap(), *render()*

drawPath(*path*)
Store a path command in the command list

Parameters
path (*QPainterPath*) – Painter path

See also
QPaintEngine.drawPath()

drawPixmap(*rect*, *pixmap*, *subRect*)
Store a pixmap command in the command list

Parameters
- **rect** (*QRectF*) – target rectangle
- **pixmap** (*QPixmap*) – Pixmap to be painted
- **subRect** (*QRectF*) – Reactangle of the pixmap to be painted

See also
QPaintEngine.drawPixmap()

drawImage(*rect*, *image*, *subRect*, *flags*)
Store a image command in the command list

Parameters
- **rect** (*QRectF*) – target rectangle
- **image** (*QImage*) – Pixmap to be painted
- **subRect** (*QRectF*) – Reactangle of the pixmap to be painted
- **flags** (*Qt.ImageConversionFlags*) – Pixmap to be painted

> **See also**
>
> `QPaintEngine.drawImage()`

updateState(*state*)

Store a state command in the command list

Parameters
state (*QPaintEngineState*) – State to be stored

> **See also**
>
> `QPaintEngine.updateState()`

5.11 QwtInterval

class qwt.interval.**QwtInterval**(*minValue=0.0*, *maxValue=-1.0*, *borderFlags=None*)

A class representing an interval

The interval is represented by 2 doubles, the lower and the upper limit.

class QwtInterval(*minValue=0.*, *maxValue=-1.*, *borderFlags=None*)

Build an interval with from min/max values

Parameters

- **minValue** (*float*) – Minimum value
- **maxValue** (*float*) – Maximum value
- **borderFlags** (*int*) – Include/Exclude borders

setInterval(*minValue*, *maxValue*, *borderFlags=None*)

Assign the limits of the interval

Parameters

- **minValue** (*float*) – Minimum value
- **maxValue** (*float*) – Maximum value
- **borderFlags** (*int*) – Include/Exclude borders

setBorderFlags(*borderFlags*)

Change the border flags

Parameters
borderFlags (*int*) – Include/Exclude borders

> **See also**
>
> *borderFlags()*

borderFlags()

Returns
Border flags

See also

setBorderFlags()

setMinValue(*minValue*)

Assign the lower limit of the interval

Parameters
minValue (*float*) – Minimum value

setMaxValue(*maxValue*)

Assign the upper limit of the interval

Parameters
maxValue (*float*) – Maximum value

minValue()

Returns
Lower limit of the interval

maxValue()

Returns
Upper limit of the interval

isValid()

A interval is valid when minValue() <= maxValue(). In case of *QwtInterval.ExcludeBorders* it is true when minValue() < maxValue()

Returns
True, when the interval is valid

width()

The width of invalid intervals is 0.0, otherwise the result is maxValue() - minValue().

Returns
the width of an interval

isNull()

Returns
true, if isValid() && (minValue() >= maxValue())

invalidate()

The limits are set to interval [0.0, -1.0]

See also

isValid()

normalized()

Normalize the limits of the interval

If maxValue() < minValue() the limits will be inverted.

Returns
Normalized interval

See also

isValid(), *inverted()*

inverted()

Invert the limits of the interval

Returns
Inverted interval

See also

normalized()

contains(*value*)

Test if a value is inside an interval

Parameters
value (*float*) – Value

Returns
true, if value >= minValue() && value <= maxValue()

unite(*other*)

Unite two intervals

Parameters
other (qwt.interval.QwtInterval) – other interval to united with

Returns
united interval

intersect(*other*)

Intersect two intervals

Parameters
other (qwt.interval.QwtInterval) – other interval to intersect with

Returns
intersected interval

intersects(*other*)

Test if two intervals overlap

Parameters
other (qwt.interval.QwtInterval) – other interval

Returns
True, when the intervals are intersecting

symmetrize(*value*)

Adjust the limit that is closer to value, so that value becomes the center of the interval.

Parameters
value (*float*) – Center

Returns
Interval with value as center

limited(*lowerBound*, *upperBound*)

Limit the interval, keeping the border modes

Parameters

- **lowerBound** (*float*) – Lower limit
- **upperBound** (*float*) – Upper limit

Returns
Limited interval

extend(*value*)

Extend the interval

If value is below minValue(), value becomes the lower limit. If value is above maxValue(), value becomes the upper limit.

extend() has no effect for invalid intervals

Parameters
value (*float*) – Value

Returns
extended interval

5.12 QwtPlotDirectPainter

class qwt.plot_directpainter.**QwtPlotDirectPainter**(*parent=None*)

Painter object trying to paint incrementally

Often applications want to display samples while they are collected. When there are too many samples complete replots will be expensive to be processed in a collection cycle.

QwtPlotDirectPainter offers an API to paint subsets (f.e all additions points) without erasing/repainting the plot canvas.

On certain environments it might be important to calculate a proper clip region before painting. F.e. for Qt Embedded only the clipped part of the backing store will be copied to a (maybe unaccelerated) frame buffer.

Warning

Incremental painting will only help when no replot is triggered by another operation (like changing scales) and nothing needs to be erased.

Paint attributes:

- *QwtPlotDirectPainter.AtomicPainter*:

Initializing a *QPainter* is an expensive operation. When *AtomicPainter* is set each call of *drawSeries()* opens/closes a temporary *QPainter*. Otherwise *QwtPlotDirectPainter* tries to use the same *QPainter* as long as possible.

- *QwtPlotDirectPainter.FullRepaint*:

  When *FullRepaint* is set the plot canvas is explicitly repainted after the samples have been rendered.

- *QwtPlotDirectPainter.CopyBackingStore*:

  When *QwtPlotCanvas.BackingStore* is enabled the painter has to paint to the backing store and the widget. In certain situations/environments it might be faster to paint to the backing store only and then copy the backing store to the canvas. This flag can also be useful for settings, where Qt fills the the clip region with the widget background.

`setAttribute`(*attribute*, *on=True*)

Change an attribute

Parameters

- **attribute** (*int*) – Attribute to change
- **on** (*bool*) – On/Off

See also

testAttribute()

`testAttribute`(*attribute*)

Parameters
attribute (*int*) – Attribute to be tested

Returns
True, when attribute is enabled

See also

setAttribute()

`setClipping`(*enable*)

En/Disables clipping

Parameters
enable (*bool*) – Enables clipping is true, disable it otherwise

See also

hasClipping(), *clipRegion()*, *setClipRegion()*

`hasClipping`()

Returns
Return true, when clipping is enabled

> **See also**
>
> *setClipping()*, *clipRegion()*, *setClipRegion()*

setClipRegion(*region*)

Assign a clip region and enable clipping

Depending on the environment setting a proper clip region might improve the performance heavily. F.e. on Qt embedded only the clipped part of the backing store will be copied to a (maybe unaccelerated) frame buffer device.

Parameters
region (*QRegion*) – Clip region

> **See also**
>
> *hasClipping()*, *setClipping()*, *clipRegion()*

clipRegion()

Returns
Return Currently set clip region.

> **See also**
>
> *hasClipping()*, *setClipping()*, *setClipRegion()*

drawSeries(*seriesItem*, *from_*, *to*)

Draw a set of points of a seriesItem.

When observing a measurement while it is running, new points have to be added to an existing seriesItem. drawSeries() can be used to display them avoiding a complete redraw of the canvas.

Setting *plot().canvas().setAttribute(Qt.WA_PaintOutsidePaintEvent, True)* will result in faster painting, if the paint engine of the canvas widget supports this feature.

Parameters

- **seriesItem** (qwt.plot_series.QwtPlotSeriesItem) – Item to be painted
- **from** (*int*) – Index of the first point to be painted
- **to** (*int*) – Index of the last point to be painted. If to < 0 the series will be painted to its last point.

reset()

Close the internal QPainter

eventFilter(*self*, *a0: QObject | None*, *a1: QEvent | None*) → bool

5.13 QwtPlotLayout

class qwt.plot_layout.**QwtPlotLayout**

Layout engine for QwtPlot.

It is used by the *QwtPlot* widget to organize its internal widgets or by *QwtPlot.print()* to render its content to a QPaintDevice like a QPrinter, QPixmap/QImage or QSvgRenderer.

See also

qwt.plot.QwtPlot.setPlotLayout()

Valid options:

- *QwtPlotLayout.AlignScales*: Unused
- *QwtPlotLayout.IgnoreScrollbars*: Ignore the dimension of the scrollbars. There are no scrollbars, when the plot is not rendered to widgets.
- *QwtPlotLayout.IgnoreFrames*: Ignore all frames.
- *QwtPlotLayout.IgnoreLegend*: Ignore the legend.
- *QwtPlotLayout.IgnoreTitle*: Ignore the title.
- *QwtPlotLayout.IgnoreFooter*: Ignore the footer.

setCanvasMargin(*margin*, *axis=-1*)

Change a margin of the canvas. The margin is the space above/below the scale ticks. A negative margin will be set to -1, excluding the borders of the scales.

Parameters

- **margin** (*int*) – New margin
- **axisId** (*int*) – Axis index

See also

canvasMargin()

Warning

The margin will have no effect when *alignCanvasToScale()* is True

canvasMargin(*axisId*)

Parameters
axisId (*int*) – Axis index

Returns
Margin around the scale tick borders

See also

setCanvasMargin()

setAlignCanvasToScales(**args*)

Change the align-canvas-to-axis-scales setting.

setAlignCanvasToScales(on):

Set the align-canvas-to-axis-scales flag for all axes

Parameters
on (*bool*) – True/False

setAlignCanvasToScales(axisId, on):

Change the align-canvas-to-axis-scales setting. The canvas may:

- extend beyond the axis scale ends to maximize its size,
- align with the axis scale ends to control its size.

The axisId parameter is somehow confusing as it identifies a border of the plot and not the axes, that are aligned. F.e when *QwtPlot.yLeft* is set, the left end of the the x-axes (*QwtPlot.xTop*, *QwtPlot.xBottom*) is aligned.

Parameters
- **axisId** (*int*) – Axis index
- **on** (*bool*) – True/False

See also

setAlignCanvasToScale(), *alignCanvasToScale()*

alignCanvasToScale(*axisId*)

Return the align-canvas-to-axis-scales setting. The canvas may:

- extend beyond the axis scale ends to maximize its size
- align with the axis scale ends to control its size.

Parameters
axisId (*int*) – Axis index

Returns
align-canvas-to-axis-scales setting

See also

setAlignCanvasToScale(), *setCanvasMargin()*

setSpacing(*spacing*)

Change the spacing of the plot. The spacing is the distance between the plot components.

Parameters
spacing (*int*) – New spacing

See also

setCanvasMargin(), *spacing()*

spacing()

Returns
Spacing

See also

`margin()`, *setSpacing()*

`setLegendPosition`(**args*)

Specify the position of the legend

`setLegendPosition(pos, [ratio=0.]):`

Specify the position of the legend

Parameters
- **pos** (*QwtPlot.LegendPosition*) – Legend position
- **ratio** (*float*) – Ratio between legend and the bounding rectangle of title, footer, canvas and axes

The legend will be shrunk if it would need more space than the given ratio. The ratio is limited to]0.0 .. 1.0]. In case of <= 0.0 it will be reset to the default ratio. The default vertical/horizontal ratio is 0.33/0.5.

Valid position values:
- *QwtPlot.LeftLegend*,
- *QwtPlot.RightLegend*,
- *QwtPlot.TopLegend*,
- *QwtPlot.BottomLegend*

See also

setLegendPosition()

`legendPosition`()

Returns
Position of the legend

See also

legendPosition()

`setLegendRatio`(*ratio*)

Specify the relative size of the legend in the plot

Parameters
ratio (*float*) – Ratio between legend and the bounding rectangle of title, footer, canvas and axes

The legend will be shrunk if it would need more space than the given ratio. The ratio is limited to]0.0 .. 1.0]. In case of <= 0.0 it will be reset to the default ratio. The default vertical/horizontal ratio is 0.33/0.5.

See also

legendRatio()

`legendRatio`()

Returns
The relative size of the legend in the plot.

See also

setLegendRatio()

`setTitleRect`(*rect*)

Set the geometry for the title

This method is intended to be used from derived layouts overloading *activate()*

Parameters
rect (*QRectF*) – Rectangle

See also

titleRect(), *activate()*

`titleRect`()

Returns
Geometry for the title

See also

invalidate(), *activate()*

`setFooterRect`(*rect*)

Set the geometry for the footer

This method is intended to be used from derived layouts overloading *activate()*

Parameters
rect (*QRectF*) – Rectangle

See also

footerRect(), *activate()*

`footerRect`()

Returns
Geometry for the footer

> **See also**
>
> *invalidate()*, *activate()*

setLegendRect(*rect*)

Set the geometry for the legend

This method is intended to be used from derived layouts overloading *activate()*

Parameters
rect (*QRectF*) – Rectangle for the legend

> **See also**
>
> *footerRect()*, *activate()*

legendRect()

Returns
Geometry for the legend

> **See also**
>
> *invalidate()*, *activate()*

setScaleRect(*axis*, *rect*)

Set the geometry for an axis

This method is intended to be used from derived layouts overloading *activate()*

Parameters

- **axisId** (*int*) – Axis index
- **rect** (*QRectF*) – Rectangle for the scale

> **See also**
>
> *scaleRect()*, *activate()*

scaleRect(*axis*)

Parameters
axisId (*int*) – Axis index

Returns
Geometry for the scale

> **See also**
>
> *invalidate()*, *activate()*

setCanvasRect(*rect*)

Set the geometry for the canvas

This method is intended to be used from derived layouts overloading *activate()*

Parameters
rect (*QRectF*) – Rectangle

See also

canvasRect(), *activate()*

canvasRect()

Returns
Geometry for the canvas

See also

invalidate(), *activate()*

invalidate()

Invalidate the geometry of all components.

See also

activate()

minimumSizeHint(*plot*)

Parameters
plot (qwt.plot.QwtPlot) – Plot widget

Returns
Minimum size hint

See also

qwt.plot.QwtPlot.minimumSizeHint()

layoutLegend(*options*, *rect*)

Find the geometry for the legend

Parameters

- **options** – Options how to layout the legend
- **rect** (*QRectF*) – Rectangle where to place the legend

Returns
Geometry for the legend

alignLegend(*canvasRect*, *legendRect*)

Align the legend to the canvas

Parameters

- **canvasRect** (*QRectF*) – Geometry of the canvas
- **legendRect** (*QRectF*) – Maximum geometry for the legend

Returns
Geometry for the aligned legend

expandLineBreaks(*options*, *rect*)

Expand all line breaks in text labels, and calculate the height of their widgets in orientation of the text.

Parameters

- **options** – Options how to layout the legend
- **rect** (*QRectF*) – Bounding rectangle for title, footer, axes and canvas.

Returns
tuple *(dimTitle, dimFooter, dimAxes)*

Returns:

- *dimTitle*: Expanded height of the title widget
- *dimFooter*: Expanded height of the footer widget
- *dimAxes*: Expanded heights of the axis in axis orientation.

alignScales(*options*, *canvasRect*, *scaleRect*)

Align the ticks of the axis to the canvas borders using the empty corners.

Parameters

- **options** – Options how to layout the legend
- **canvasRect** (*QRectF*) – Geometry of the canvas (IN/OUT)
- **scaleRect** (*QRectF*) – Geometry of the scales (IN/OUT)

activate(*plot*, *plotRect*, *options=0*)

Recalculate the geometry of all components.

Parameters

- **plot** (qwt.plot.QwtPlot) – Plot to be layout
- **plotRect** (*QRectF*) – Rectangle where to place the components
- **options** – Layout options

5.14 Plotting series item

5.14.1 QwtPlotSeriesItem

class qwt.plot_series.**QwtPlotSeriesItem**(*title*)

Base class for plot items representing a series of samples

`setOrientation`(*orientation*)

Set the orientation of the item. Default is *Qt.Horizontal*.

The *orientation()* might be used in specific way by a plot item. F.e. a QwtPlotCurve uses it to identify how to display the curve int *QwtPlotCurve.Steps* or *QwtPlotCurve.Sticks* style.

See also

:py:meth`orientation()`

`orientation`()

Returns

Orientation of the plot item

See also

:py:meth`setOrientation()`

`draw`(*painter*, *xMap*, *yMap*, *canvasRect*)

Draw the complete series

Parameters

- **painter** (*QPainter*) – Painter
- **xMap** (qwt.scale_map.QwtScaleMap) – Maps x-values into pixel coordinates.
- **yMap** (qwt.scale_map.QwtScaleMap) – Maps y-values into pixel coordinates.
- **canvasRect** (*QRectF*) – Contents rectangle of the canvas

`drawSeries`(*painter*, *xMap*, *yMap*, *canvasRect*, *from_*, *to*)

Draw a subset of the samples

Parameters

- **painter** (*QPainter*) – Painter
- **xMap** (qwt.scale_map.QwtScaleMap) – Maps x-values into pixel coordinates.
- **yMap** (qwt.scale_map.QwtScaleMap) – Maps y-values into pixel coordinates.
- **canvasRect** (*QRectF*) – Contents rectangle of the canvas
- **from** (*int*) – Index of the first point to be painted
- **to** (*int*) – Index of the last point to be painted. If to < 0 the curve will be painted to its last point.

See also

This method is implemented in *qwt.plot_curve.QwtPlotCurve*

`boundingRect`()

Returns

An invalid bounding rect: QRectF(1.0, 1.0, -2.0, -2.0)

> **Note**
>
> A width or height < 0.0 is ignored by the autoscaler

5.14.2 QwtSeriesData

class qwt.plot_series.**QwtSeriesData**

Abstract interface for iterating over samples

PythonQwt offers several implementations of the QwtSeriesData API, but in situations, where data of an application specific format needs to be displayed, without having to copy it, it is recommended to implement an individual data access.

A subclass of *QwtSeriesData* must implement:

- size():

  Should return number of data points.

- sample()

  Should return values x and y values of the sample at specific position as QPointF object.

- boundingRect()

  Should return the bounding rectangle of the data series. It is used for autoscaling and might help certain algorithms for displaying the data. The member *_boundingRect* is intended for caching the calculated rectangle.

setRectOfInterest(*rect*)

Set a the "rect of interest"

QwtPlotSeriesItem defines the current area of the plot canvas as "rectangle of interest" (QwtPlotSeriesItem::updateScaleDiv()). It can be used to implement different levels of details.

The default implementation does nothing.

Parameters
rect (*QRectF*) – Rectangle of interest

size()

Returns
Number of samples

sample(*i*)

Return a sample

Parameters
i (*int*) – Index

Returns
Sample at position i

boundingRect()

Calculate the bounding rect of all samples

The bounding rect is necessary for autoscaling and can be used for a couple of painting optimizations.

Returns
Bounding rectangle

5.14.3 QwtPointArrayData

class qwt.plot_series.**QwtPointArrayData**(*x=None*, *y=None*, *size=None*, *finite=None*)

Interface for iterating over two array objects

class **QwtCQwtPointArrayDataolorMap**(*x*, *y*[, *size=None*])

Parameters

- **x** (*list or tuple or numpy.array*) – Array of x values
- **y** (*list or tuple or numpy.array*) – Array of y values
- **size** (*int*) – Size of the x and y arrays
- **finite** (*bool*) – if True, keep only finite array elements (remove all infinity and not a number values), otherwise do not filter array elements

boundingRect()

Calculate the bounding rectangle

The bounding rectangle is calculated once by iterating over all points and is stored for all following requests.

Returns
Bounding rectangle

size()

Returns
Size of the data set

sample(*index*)

Parameters
index (*int*) – Index

Returns
Sample at position *index*

xData()

Returns
Array of the x-values

yData()

Returns
Array of the y-values

5.14.4 QwtSeriesStore

class qwt.plot_series.**QwtSeriesStore**

Class storing a *QwtSeriesData* object

QwtSeriesStore and *QwtPlotSeriesItem* are intended as base classes for all plot items iterating over a series of samples.

setData(*series*)

Assign a series of samples

Parameters
series (qwt.plot_series.QwtSeriesData) – Data

Warning

The item takes ownership of the data object, deleting it when its not used anymore.

`data`()

Returns
the series data

`sample`(*index*)

Parameters
index (*int*) – Index

Returns
Sample at position index

`dataSize`()

Returns
Number of samples of the series

See also

setData(), *qwt.plot_series.QwtSeriesData.size()*

`dataRect`()

Returns
Bounding rectangle of the series or an invalid rectangle, when no series is stored

See also

qwt.plot_series.QwtSeriesData.boundingRect()

`setRectOfInterest`(*rect*)

Set a the "rect of interest" for the series

Parameters
rect (*QRectF*) – Rectangle of interest

See also

qwt.plot_series.QwtSeriesData.setRectOfInterest()

`swapData`(*series*)

Replace a series without deleting the previous one

Parameters
series (qwt.plot_series.QwtSeriesData) – New series

Returns
Previously assigned series

5.15 Coordinate tranformations

5.15.1 QwtTransform

class qwt.transform.**QwtTransform**

A transformation between coordinate systems

QwtTransform manipulates values, when being mapped between the scale and the paint device coordinate system.

A transformation consists of 2 methods:

- transform
- invTransform

where one is is the inverse function of the other.

When p1, p2 are the boundaries of the paint device coordinates and s1, s2 the boundaries of the scale, QwtScaleMap uses the following calculations:

```
p = p1 + (p2 - p1) * ( T(s) - T(s1) / (T(s2) - T(s1)) )
s = invT( T(s1) + ( T(s2) - T(s1) ) * (p - p1) / (p2 - p1) )
```

bounded(*value*)

Modify value to be a valid value for the transformation. The default implementation does nothing.

transform(*value*)

Transformation function

Parameters
value (*float*) – Value

Returns
Modified value

See also

invTransform()

invTransform(*value*)

Inverse transformation function

Parameters
value (*float*) – Value

Returns
Modified value

See also

transform()

copy()

Returns
Clone of the transformation

The default implementation does nothing.

5.15.2 QwtNullTransform

class qwt.transform.**QwtNullTransform**

transform(*value*)

Transformation function

Parameters
value (*float*) – Value

Returns
Modified value

See also

invTransform()

invTransform(*value*)

Inverse transformation function

Parameters
value (*float*) – Value

Returns
Modified value

See also

transform()

copy()

Returns
Clone of the transformation

5.15.3 QwtLogTransform

class qwt.transform.**QwtLogTransform**

Logarithmic transformation

QwtLogTransform modifies the values using *numpy.log()* and *numpy.exp()*.

Note

In the calculations of *QwtScaleMap* the base of the log function has no effect on the mapping. So *QwtLogTransform* can be used for logarithmic scale in base 2 or base 10 or any other base.

Extremum values:

- *QwtLogTransform.LogMin*: Smallest allowed value for logarithmic scales: 1.0e-150
- *QwtLogTransform.LogMax*: Largest allowed value for logarithmic scales: 1.0e150

bounded(*value*)

Modify value to be a valid value for the transformation.

Parameters
value (*float*) – Value to be bounded

Returns
Value modified

transform(*value*)

Transformation function

Parameters
value (*float*) – Value

Returns
Modified value

See also

invTransform()

invTransform(*value*)

Inverse transformation function

Parameters
value (*float*) – Value

Returns
Modified value

See also

transform()

copy()

Returns
Clone of the transformation

5.15.4 QwtPowerTransform

class qwt.transform.**QwtPowerTransform**(*exponent*)

A transformation using *numpy.pow()*

QwtPowerTransform preserves the sign of a value. F.e. a transformation with a factor of 2 transforms a value of -3 to -9 and v.v. Thus *QwtPowerTransform* can be used for scales including negative values.

transform(*value*)

Transformation function

Parameters
value (*float*) – Value

Returns
Modified value

> **See also**
>
> *invTransform()*

invTransform(*value*)

Inverse transformation function

Parameters
value (*float*) – Value

Returns
Modified value

> **See also**
>
> *transform()*

copy()

Returns
Clone of the transformation

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