wxmplot documentation

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CONTENTS

The wxmplot python package provides simple, rich plotting widgets for wxPython. These are built on top of the matplotlib library, which provides a wonderful library for 2D plots and image display. The wxmplot package does not attempt to expose all of matplotlib's capabilities, but does provide widgets (wxPython panels) for basic 2D plotting and image display that handle many use cases. The widgets are designed to be very easy to program with, and provide end-users with interactivity and customization of the graphics without knowing matplotlib.

The wxmplot package is aimed at programmers who want decent scientific graphics for their applications that can be manipulated by the end-user. If you're a python programmer, comfortable writing matplotlib / pylab scripts, or plotting interactively from IPython, this package may seem to limiting for your needs.

CHAPTER

ONE

DOWNLOADING AND INSTALLATION

1.1 Prerequisites

The wxmplot package requires Python, wxPython, numpy, and matplotlib. Some of the example applications rely on the Image module as well.

1.2 Downloads

The latest version is available from PyPI or CARS (Univ of Chicago):

Download Option	**Python Versions**	**Location**
Source Kit	2.6, 2.7	• wxmplot-0.9.6.tar.gz (CARS) • wxmplot-0.9.6.tar.gz (PyPI) • wxmplot-0.9.6.zip (CARS) • wxmplot-0.9.6.zip (PyPI)
Development Version	all	use wxmplot github repository

if you have Python Setup Tools installed, you can download and install the package simply with:

```
easy_install -U wxmplot
```

1.3 Development Version

To get the latest development version, use:

```
git clone http://github.com/newville/wxmplot.git
```

1.4 Installation

This is a pure python module, so installation fon all platforms can use the source kit:

```
tar xvzf wxmplot-0.9.6.tar.gz  or unzip wxmplot-0.9.6.zip
cd wxmplot-0.9.6/
python setup.py install
```

1.5 License

The wxmplot code is distribution under the following license:

CHAPTER

TWO

PLOTPANEL: A WX.PANEL FOR BASIC 2D LINE PLOTS

The `PlotPanel` class supports standard 2-d plots (line plots, scatter plots) with a simple-to-use programming interface. This is derived from a `wx.Panel` and so can be included in a wx GUI anywhere a `wx.Panel` can be. A `PlotPanel` provides the following capabilities for the end-user:

1. display x, y coordinates (left-click)
2. zoom in on a particular region of the plot (left-drag)
3. customize titles, labels, legend, color, linestyle, marker, and whether a grid is shown. A separate window is used to set these attributes.
4. save high-qualiy plot images (as PNGs), copy to system clipboard, or print.

A `PlotFrame` that includes a `PlotPanel`, menus, and statusbar is also provided to give a separate plotting window to an application. These both have the basic plotting methods of `plot()` to make a new plot with a single trace, and `oplot()` to overplot another trace on top of an existing plot. These each take 2 equal-length numpy arrays (abscissa, ordinate) for each trace. The `PlotPanel` and `PlotFrame` have many additional methods to interact with the plots.

class `PlotPanel` (*parent*[, *size=(6.0, 3.7)*[, *dpi=96*[, *messenger=None*[, *show_config_popup=True*[, ***kws*]]]]])

Create a Plot Panel, a `wx.Panel`

Parameters

- **parent** – wx parent object.
- **size** – figure size in inches.
- **dpi** – dots per inch for figure.
- **messenger** (callable or `None`) – function for accepting output messages.
- **show_config_popup** (`True`/`False`) – whether to enable a popup-menu on right-click.

The *size*, and *dpi* arguments are sent to matplotlib's `Figure`. The *messenger* should should be a function that accepts text messages from the panel for informational display. The default value is to use `sys.stdout.write()`.

The *show_config_popup* arguments controls whether to bind right-click to showing a poup menu with options to zoom in or out, configure the plot, or save the image to a file.

Extra keyword parameters are sent to the wx.Panel.

2.1 `PlotPanel` methods

`plot` (*x*, *y*, ***kws*)

Draw a plot of the numpy arrays *x* and *y*, erasing any existing plot. The displayed curve for these data is called a *trace*. The `plot()` method has many optional parameters, all using keyword/value argument. Since most of these are shared with the `oplot()` method, the full set of parameters is given in *Table of Arguments for plot() and oplot()*

`oplot` (*x*, *y*, ***kws*)

Draw a plot of the numpy arrays *x* and *y*, overwriting any existing plot.

The `oplot()` method has many optional parameters, as listed in *Table of Arguments for plot() and oplot()*

Table of Arguments for plot() and oplot(): Except where noted, the arguments are available for both `plot()` and `oplot()`.

argument	type	default	meaning
title	string	None	Plot title (`plot()` only)
xlabel	string	None	ordinate label (`plot()` only)
ylabel	string	None	abscissa label (`plot()` only)
y2label	string	None	right-hand abscissa label (`plot()` only)
label	string	None	trace label (defaults to 'trace N')
side	left/right	left	side for ylabel
use_dates	bool	False	to show dates in xlabel (`plot()` only)
grid	None/bool	None	to show grid lines (`plot()` only)
color	string	blue	color to use for trace
linewidth	int	2	linewidth for trace
style	string	solid	line-style for trace (solid, dashed, ...)
drawstyle	string	line	style connecting points of trace
marker	string	None	symbol to show for each point (+, o, ...)
markersize	int	8	size of marker shown for each point
dy	array	None	uncertainties for y values; error bars
ylog_scale	bool	False	draw y axis with log(base 10) scale
xmin	float	None	minimum displayed x value
xmax	float	None	maximum displayed x value
ymin	float	None	minimum displayed y value
ymax	float	None	maximum displayed y value
xylims	2x2 list	None	[[xmin, xmax], [ymin, ymax]]
autoscale	bool	True	whether to automatically set plot limits

As a general note, the configuration for the plot (title, labels, grid displays) and for each trace (color, linewidth, ...) are preserved for a `PlotPanel`. A few specific notes:

1. The title, label, and grid arguments to `plot()` default to `None`, which means to use the previously used value.
2. The *use_dates* option is not very rich, and simply turns x-values that are Unix timestamps into x labels showing the dates.
3. While the default is to auto-scale the plot from the data ranges, specifying any of the limits will override the corresponding limit(s).
4. The *color* argument can be any color name ("blue", "red", "black", etc), standard X11 color names ("cadetblue3", "darkgreen", etc), or an RGB hex color string of the form "#RRGGBB".
5. Valid *style* arguments are 'solid', 'dashed', 'dotted', or 'dash-dot', with 'solid' as the default.

6. Valid *marker* arguments are '+', 'o', 'x', '^', 'v', '>', '<', '|', '_', 'square', 'diamond', 'thin diamond', 'hexagon', 'pentagon', 'tripod 1', or 'tripod 2'.

7. Valid *drawstyles* are None (which connects points with a straight line), 'steps-pre', 'steps-mid', or 'steps-post', which give a step between the points, either just after a point ('steps-pre'), midway between them ('steps-mid') or just before each point ('steps-post'). Note that if displaying discrete values as a function of time, left-to-right, and want to show a transition to a new value as a sudden step, you want 'steps-post'.

All of these values, and a few more settings controlling whether and how to display a plot legend can be configured interactively (see Plot Configuration).

`clear`()
Clear the plot.

`set_xylims`(*limits*[, *axes=None*[, *side=None*[, *autoscale=True*]]])
Set the x and y limits for a plot based on a 2x2 list.

Parameters

- **limits** (*2x2 list: [[xmin, xmax], [ymin, ymax]]*) – x and y limits
- **axes** – instance of matplotlib axes to use (i.e, for right or left side y axes)
- **side** – set to 'right' to get right-hand axes.
- **autoscale** – whether to automatically scale to data range.

That is, if *autoscale=False* is passed in, then the limits are use.

`get_xylims`()
return current x, y limits.

`unzoom`()
unzoom the plot. The x, y limits for interactive zooms are stored, and this function unzooms one level.

`unzoom_all`()
unzoom the plot to the full data range.

`update_line`(*trace*, *x*, *y*[, *side='left'*])
update an existing trace.

Parameters

- **trace** – integer index for the trace (0 is the first trace)
- **x** – array of x values
- **y** – array of y values
- **side** – which y axis to use ('left' or 'right').

This function is particularly useful for data that is changing and you wish to update the line with the new data without completely redrawing the entire plot. Using this method is substantially faster than replotting.

`set_title`(*title*)
set the plot title.

`set_xlabel`(*label*)
set the label for the ordinate axis.

`set_ylabel`(*label*)
set the label for the left-hand abscissa axis.

`set_y2label`(*label*)
set the label for the right-hand abscissa axis.

set_bgcol(*color*)
set the background color for the PlotPanel.

write_message(*message*)
write a message to the messenger. For a PlotPanel embedded in a PlotFrame, this will go the the StatusBar.

save_figure()
show a FileDialog to save a PNG image of the current plot.

configure()
show plot configuration window for customizing plot.

2.2 `PlotFrame`: a wx.Frame showing a `PlotPanel`

A `PlotFrame` is a wx.Frame – a separate plot window – that contains a `PlotPanel` and is decorated with a status bar and menubar with menu items for saving, printing and configuring plots..

class **PlotFrame**(*parent*[, *size=(700, 450)*[, *title=None*[, ***kws*]]])
create a plot frame.

The frame will have a *panel* member holding the underlying `PlotPanel`.

2.3 `PlotApp`: a wx.App showing a `PlotFrame`

A `PlotApp` is a wx.App – an application – that consists of a `PlotFrame`. This and is decorated with a status bar and menubar with menu items for saving, printing and configuring plots..

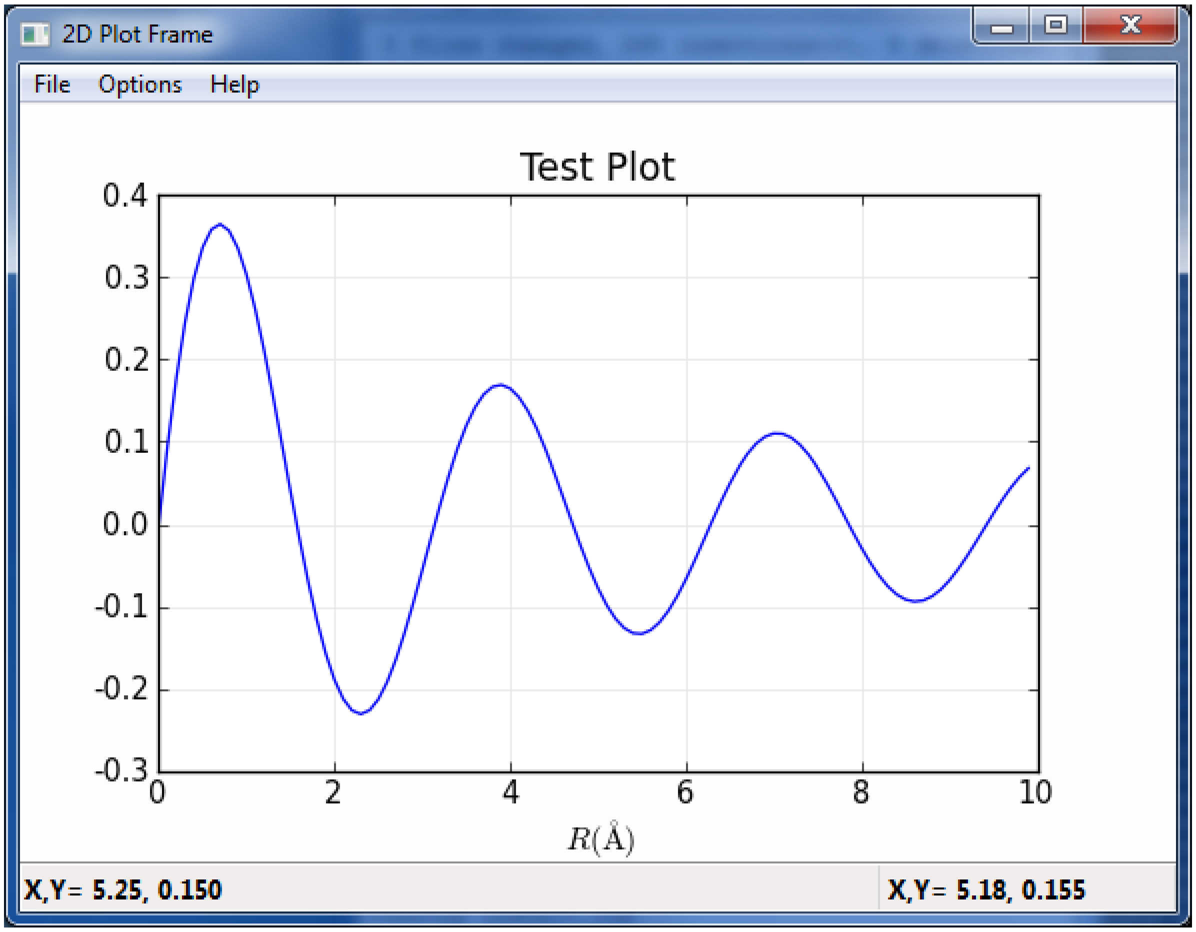
class **PlotAppp**
create a plot application. This has methods `plot()`, `oplot()`, and `write_message()`, which are sent to the underlying `PlotPanel`.

This allows very simple scripts which give plot interactivity and customization:

```
from wxmplot import PlotApp
from numpy import arange, sin, cos, exp, pi

xx   = arange(0.0,12.0,0.1)
y1   = 1*sin(2*pi*xx/3.0)
y2   = 4*cos(2*pi*(xx-1)/5.0)/(6+xx)
y3   = -pi + 2*(xx/10. + exp(-(xx-3)/5.0))

p = PlotApp()
p.plot(xx, y1, color='blue',  style='dashed',
       title='Example PlotApp',  label='a',
       ylabel=r'$k^2\chi(k) $',
       xlabel=r'$  k \ (\AA^{-1}) $' )

p.oplot(xx, y2,  marker='+', linewidth=0, label =r'$ x_1 $')
p.oplot(xx, y3,  style='solid',          label ='x_2')
p.write_message(Try Help->Quick Reference')
p.run()
```

2.4 Examples and Screenshots

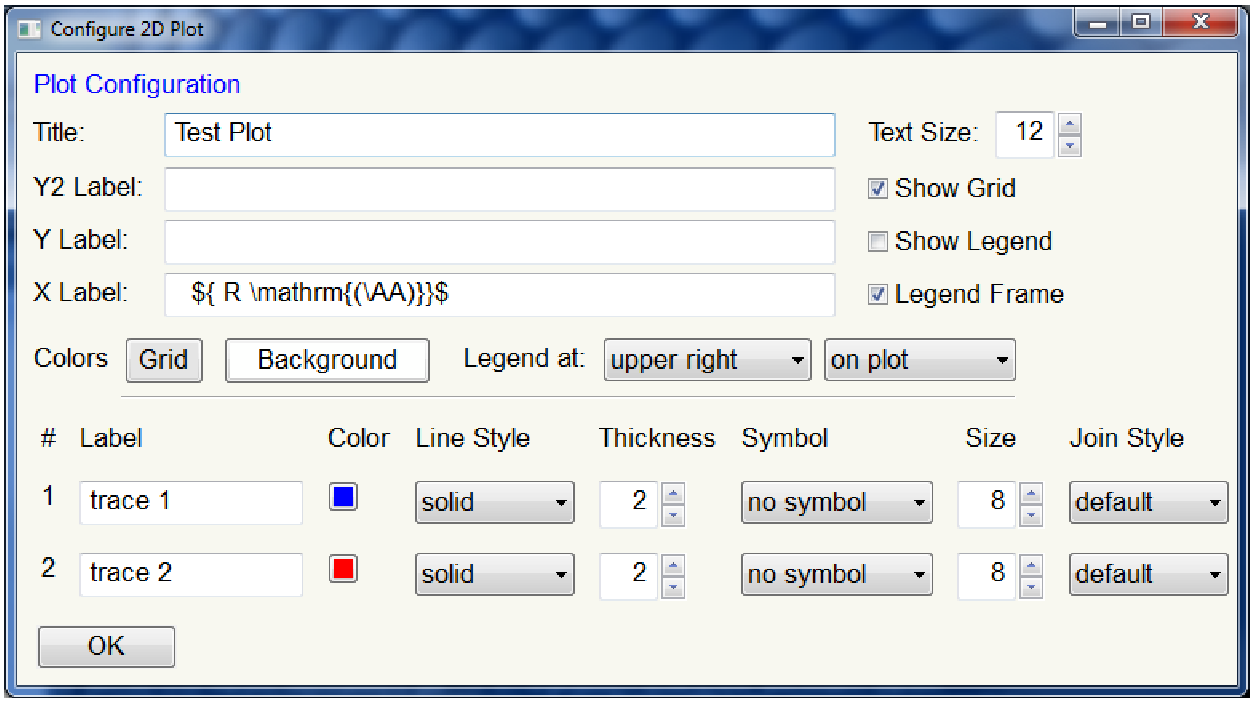
A basic plot from a PlotFrame looks like this:



X,Y= 5.25, 0.150

X,Y= 5.18, 0.155

The configuration window (Options->Configuration or Ctrl-K) for this plot looks like this:



Configure 2D Plot

Plot Configuration

Title: Test Plot

Text Size: 12

Y2 Label:

[✓] Show Grid

Y Label:

[ ] Show Legend

X Label: ${ R \mathrm{(\AA)}}$

[✓] Legend Frame

Colors: Grid | Background

Legend at: upper right | on plot

#	Label	Color	Line Style	Thickness	Symbol	Size	Join Style
1	trace 1	🟦	solid	2	no symbol	8	default
2	trace 2	🟥	solid	2	no symbol	8	default

OK

where all the options there will dynamically change the plot in the PlotPanel.

Many more examples are given in the *examples* directory in the source distribution kit. The *demo.py* script there will show several 2D Plot panel examples, including a plot which uses a timer to simulate a dynamic plot, updating the plot as fast as it can - typically 10 to 30 times per second, depending on your machine. The *stripchart.py* example script also shows a dynamic, time-based plot.

CHAPTER

THREE

`IMAGEPANEL`: A WX.PANEL FOR IMAGE DISPLAY

The `ImagePanel` class supports image display (ie, gray-scale and false-color intensity maps for 2-D arrays. As with `PlotPanel`, this is derived from a `wx.Panel` and so can be included in a wx GUI anywhere a `wx.Panel` can be. While the image can be customized programmatically, the only interactivity built in to the `ImagePanel` is the ability to zoom in and out.

In contrast, an `ImageFrame` provides many more ways to manipulate an image, and will be discussed below.

class **`ImagePanel`** (*parent*[, *size=(4.5, 4.0)*[, *dpi=96*[, *messenger=None*[, *data_callback=None*[, ***kws*]]]]])

Create an Image Panel, a `wx.Panel`

Parameters

- **parent** – wx parent object.
- **size** – figure size in inches.
- **dpi** – dots per inch for figure.
- **messenger** (callable or `None`) – function for accepting output messages.
- **data_callback** (callable or `None`) – function to call with new data, on `display()`

The *size*, and *dpi* arguments are sent to matplotlib's `Figure`. The *messenger* should should be a function that accepts text messages from the panel for informational display. The default value is to use `sys.stdout.write()`.

The *data_callback* is useful if some parent frame wants to know if the data has been changed with `display()`. `ImageFrame` uses this to display the intensity max/min values.

Extra keyword parameters are sent to the wx.Panel.

The configuration settings for an image (its colormap, smoothing, orientation, and so on) are controlled through configuration attributes.

3.1 `ImagePanel` methods

`display` (*data*[, *x=None*[, *y=None*[, ***kws*]]])

display a new image from the 2-D numpy array *data*. If provided, the *x* and *y* values will be used for display purposes, as to give scales to the pixels of the data.

Additional keyword arguments will be sent to a *data_callback* function, if that has been defined.

3.2 `ImageFrame`: A wx.Frame for Image Display

In addition to providing a top-level window frame holding an `ImagePanel`, an `ImageFrame` provides the end-user with many ways to manipulate the image:

1. display x, y, intensity coordinates (left-click)
2. zoom in on a particular region of the plot (left-drag).
3. change color maps.
4. flip and rotate image.
5. select optional smoothing interpolation.
6. modify intensity scales.
7. save high-qualiy plot images (as PNGs), copy to system clipboard, or print.

These options are all available programmatically as well, by setting the configuration attributes and redrawing the image.

class `ImageFrame` (*parent*[, *size=(550, 450)*[, ***kws*]])
Create an Image Frame, a `wx.Frame`.

3.3 Image configuration with `ImageConfig`

To change any of the attributes of the image on an `ImagePanel`, you can set the corresponding attribute of the panel's `conf`. That is, if you create an `ImagePanel`, you can set the colormap with:

```
import matplotlib.cm as cmap
im_panel = ImagePanel(parent)
im_panel.display(data_array)

# now change colormap:
im_panel.conf.cmap = cmap.cool
im_panel.redraw()

# now rotate the image by 90 degrees (clockwise):
im_panel.conf.rot = True
im_panel.redraw()
```

For a `ImageFrame`, you can access this attribute as *frame.panel.conf.cmap*.

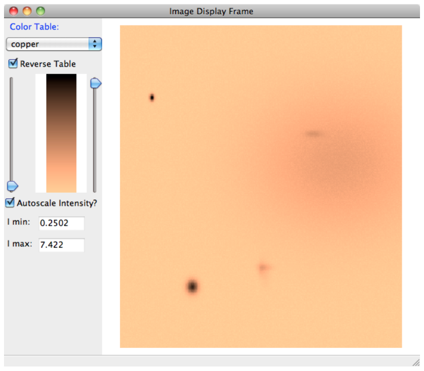
The list of configuration attributes and their meaning are given in the *Table of Image Configuration attributes* Table of Image Configuration attributes: All of these are members of the *panel.conf* object, as shown in the example above.

attribute	type	default	meaning
rot	bool	False	rotate image 90 degrees clockwise
flip_ud	bool	False	flip image top/bottom
flip_lr	bool	False	flip image left/right
log_scale	bool	False	display log(image)
auto_intensity	bool	True	auto-scale the intensity

cmap cmap_reverse interp xylims cmap_lo cmap_hi int_lo int_hi

3.4 Examples and Screenshots

A basic plot from a `ImageFrame` looks like this:



Color Table: copper

Reverse Table ✓

Autoscale Intensity? ✓

I min: 0.2502

I max: 7.422

This screenshot (from Mac OS X) doesn't show the top menu, which includes menus for rotating or flipping the image, selecting an interpolation scheme, or saving PNG images of either the image or the colormap.

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