Testing CASA with Matplotlib 0.99.1.1

0. Test environment
   - OS: Scientific Linux 5.3 (32-bit) emulated by VMware Player on WindowsXP
   - Package versions
     - Matplotlib: 0.99.1.1
     - CASA: rev. 11753 (DLed 10 Jun. 2010)
     - ASAP: rev. 1757 in ATNF-ALMA branch (DLed 10 Jun. 2010, the one just after merging ASAP 3.0.0 development)

1. Building Matplotlib-0.99.1.1

   The way to build Matplotlib-0.99.1.1 with casapy-python is very easy:

   A) remove `matplotlib/` and `matplotlib-0.91.4-py2.5.egg-info`
   The default path to them are `/usr/lib/casapy/lib/python2.5/site-packages/` on 32-bit Linux.

   B) download Matplotlib 0.99.1.1 tarball
   DL matplotlib tarball from sourceforge:
   http://sourceforge.net/projects/matplotlib/files/matplotlib/matplotlib-0.99.1/

   C) build matplotlib from source
   expand matplotlib-0.99.1.2.tar.gz
   ```
   $ tar zxvf matplotlib-0.99.1.2.tar.gz
   ```
   --> matplotlib-0.99.1.1/ is generated
   build matplotlib with python in casapy (you need gcc and tk-devel rpm installed)
   ```
   $ cd matplotlib-0.99.1.1/
   $ /usr/lib/casapy/bin/python setup.py build
   $ su
   # /usr/lib/casapy/bin/python setup.py install
   ```
   matplotlib will be installed to /usr/lib/casapy/lib/python2.5/site-packages/
   matplotlib/ matplotlib-0.99.1.1-py2.5.egg-info and mpl_toolkits/ are created.

   D) Check upgrade (optional)
   - load casapy and check matplotlib version
     ```
     CASA <>: matplotlib.__version__
     Out[]: '0.99.1.1'
     ```
   - test if new features in Matplotlib >= 0.98
     Try `pylab.ginput`
     ```
     CASA <>: x=pl.array(range(50))
     ```

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```
CASA <>: y=x/2.
CASA <>: pl.plot(x,y,'ro')
CASA <>: pl.ginput(n=2,timeout=0)
  Out[]:
[(15.260545905707195, 15.56122448979592),
 (30.248138957816373, 7.9081632653061238)]
```

Check : click on the plot twice on the plot and you get data position (and '+' signs on the plot) you clicked.

2. Tests & Results

So far, there are three different plotters in CASA which are based on Matplotlib, i.e., TablePlot (plotcal, plotants, and plotxy are based on this plotter), ASAP plotter (single dish plotter), and functions which directly calls pyplot (Matplotlib) functions as in simulator tasks. I did tests for (1) plotting with various plot parameter settings, (2) plotter buttons, and (3) combination with other functions (ex. interactive region selection, [un]flagging, [un]masking).
Note Tests A) - D) below are for TablePlot.

A) plotxy: plotting with possible plot parameter settings (run plotxy_regression.py)

- plotting itself (non-interactive): good.
- 'Next' button: works fine
- regression results:
  Regression didn't pass due to very small difference of symbol size and line thikness. But I compared plot images by 0.91.4 and 0.99.1, and they are fine.

B) Buttons on TablePlot

TablePlot has an additional tool bar which is developed for CASA and also the actions of buttons in default tool bar are overwritten in TablePlotTkAgg.py. This requires tests for all GUI buttons on TablePlot.
During plotxy regression test, I noticed that 3 buttons on TablePlot, 'Mark region', 'Zoom', and 'Pan', wouldn't work with Matplotlib-0.99.1.1. It was due to interface changes in 0.98. After dealing with several interface changes in TableplotTkAgg.py, the all buttons work fine.
Note that I modified the code so that it works with both Matplotlib-0.99.1 (new) and 0.91.4 (current).
The followings are the test results after dealing with the interface changes of Matplotlib for functions called in TableplotTkAgg.py.
GUI buttons are tested on a plot loaded with the command:

```
CASA <>: plotxy(vis='B0319_0317.ms',xaxis='time',yaxis='amp',
```

`datacolumn='data',subplot=111,clearpanel='All')`

`B0319_0317.ms` is an MS generated by b0319_regression.py

Home / Back / Forward / Pan / Zoom / Adjust layout / Save: ok

Quit: ok

Mark region: properly marks and returns selected region.

Locate: prints proper location info on the logger.

Flag: properly removes selected data points on the plot. Also FLAG column in the MS is updated properly.

Unflag: properly replots selected data points on the plot. Also FLAG column in the MS is updated properly.

C) the other regressions which calls plotxy and/or plotcal

b0319_regression.py: ok

D) test plotants task

`CASA <>: plotants(vis='n4826_16apr.ms',figfile='n4826ants.png')`

- plotting itself: ok
- output figure: ok

E) sdplot (ASAP plotter)

ASAP plotter is originally developed by ATNF developers and it is based on Matplotlib >=0.98. So I don't expect problems in original functionalities, although also tested. On the other hand, I tested carefully and made sure that our developments don't have problems, i.e., additional toolbar (casatoolbar.py), interactive mask/unmask (interactivemask.py), printing header information on the plot and controlling plot layout (sdplot).

- plotting itself: ok

  Tested possible plottypes, axis units, panels and stack selections, plot styles, and setting plot ranges.

  This can be made to a test script for sdplot in future.

  Header on/off and fontsize control works fine.

  The plot layout and legend location control work well.

- default plotter buttons: ok, of course.

  Home / Back / Forward / Pan / Zoom / Adjust layout / Save: ok

- additional toolbar buttons (casatoolbar.py & interactivemask.py)… work fine

  spec value button: shows the spectral value of a selected spectrum and pointed channels.

  statistics button: region selection is ok. statistic results agree with the values calculated in sdstat.

Quit: ok.

- combination with interactive tasks(interactivemask.py)
  sdstat: ok … interactive region selection works fine. Statistics are equalt to those by specifying mask list.
  sdbaseline: ok … interactive region selection works fine. Baseline results and rms are equal to those by specifying mask lists.
  sdfit: ok … interactive region selection works fine. Baseline results and rms are equal to those by specifying line regions.

F) plots in simulator tasks (calling Matplotlib functions directly)
I ran simdata2 task with `display='both'`. The parameter set is the same as the one in ghii2_regression.py.
The plots are displayed without any error/warning messages. The plot results were fine. Of course all the GUI buttons work as expected.

3. Summary

I tested whether or not upgrading Matplotlib to 0.99.1.1 has serious impacts on the current plotting functionalities in CASA. The test was carried out on Scientific Linux 5.3 (32-bit). CASA 11753 and Matplotlib 0.99.1.1 were built from source for testing. So far, CASA has 3 types of plot functions which depend on Matplotlib, i.e., TablePlot (plotcal plotxy, and plotants), ASAP plotter (sdplot), and plot functions in simulator utility. I tested all three plotters and checked if plotting itself, GUI buttons, and combinations with the other functions (such as flagging and masking) work fine or not with Matplotlib-0.99.1.1. The only issue I found was TablePlotTkAgg.py which calls several functions not available in Matplotlib-0.99.1. However, I could do a bit of workaround and make the code work with both new and old Matplotlibs. I will commit it at the beginning of next week. Therefore, my conclusion is that it's time to get a fresh Matplotlib!

Kana Sugimoto (2010/06/11)