# Summary of Image and Plotting Software (IPS) packages collected

# for possible use with GLAST Science Analysis Tools

For the Science Analysis Tools, we will need the capability to make plots, and display images on the screen. It would not be an efficient use of our manpower to write a custom set of plotting tools if we can find a package available that satisfies our needs. To this end the User Interface committee has settled on a list of basic requirements for science analysis graphics and have begun to look at some packages. The packages and their characteristics are contained in table 1 below.

It seems quite clear that the choice of package is intimately related to the scope of what we want to do. For example if our tools only have to put up plots and images with minimal interactive analysis, then the plotting packages (the first group in table 1) are desirable. If we want to have more complicated interactions with the user and more extensive image manipulation (rotatable images, e.g.), then something more like a graphic toolkit would be desirable. If we decide to go the latter route and use a tool like Qt, then we need programmers to start working immediately to create the basic plotting classes and methods to ensure this does not hold up development of the science tools. The basic requirements have already reduced the number of packages to < 20, but we need to better define the requirements in greater detail to narrow it down to two or three packages.

Basic requirements (IPS= Image and Plotting Software):

- 1) The IPS must be freely available for use, modification, and re-distribution.
- 2) Any external libraries used by the IPS must be well-supported, tested, and free.
- 3) The IPS must be available on all supported platforms.
- 4) The IPS must provide an API for C++, and optionally, for JAVA or for a high-level scripting language.
- 5) The IPS must be extensible, allowing the creation of custom widgets.
- 6) The IPS must be simple to install, preferably through a binary distribution for end-users.
- 7) IPS must be able to generate publication quality images, including PostScript.
- 8) The IPS must allow export of images into standard browser supported formats (e.g., GIF, JPEG, TIFF, etc.)
- 9) The IPS must provide facilities to create line, scatter, and contour plots.
- 10) Support for 3D and surface plots is desirable.
- 11) Plots shall be modifiable, rather than forcing regeneration of plots from scratch.
- 12) Users shall have control over plot details such as axis range, bin size, linear vs. logarithmic scaling, etc.
- 13) The IPS must display and possibly rotate images.
- 14) The IPS must support overlaying of images and contours and images and plotted points.
- 15) The IPS must provide for returning interactive graphical inputs such as cursor position.
- 16) Multiple color tables must be available, including a facility for specifying user-defined color tables.
- 17) Color tables must be scalable, preferably via mouse or cursor inputs.
- 18) The display rate should be less than about 2 seconds for tasks that are not data intensive.
- 19) Interactive sessions should provide logging capabilities.

The columns on the table are answers to questions listed below. The tools are broken up into 3 groups: first - plotting tools, last - image manipulation/ graphics tools, and the middle group is somewhere between. All packages listed on this page are freeware.

Widgets – Is the package capable of making custom widgets?

Plottype - Plots all of the following: histograms, scatter, countour, 3D?

Image Man - Does Image manipulation: overlays, rotation, rescaling of images?

Pkg Type – Is The package a library (L), an analysis environment (E), i.e., need to enter commands in its own defined macros, or both (B)

API – What is a program interface for our macros? What language (F=fortran, C=C or C++, L=command line O=other)

Platforms - runs on Linux, Windows, Solaris?

Life - Is it supported? Is it likely to still be supported after 2006?

Dep. - Does it NOT depend in a complicated way on other software pckgs/libs?

Qual - Does it produce publication quality graphs?

Out - Does it produce output that can be easily displayed in a browser?

#### TARLE 1

	TABLE 1									
Package	Widg	Plot	Image	Pkg	API	Plat	Lif	Dep.	Qual	Out
	ets	Type	Man	Type		forms	e			
Plotting tools										
Dataplot	N?	Y	N	Е	F	Y	Y	Y	Y	Y
Grace	N	Y/no 3-d	N	В	C/F	Y	Y?	Y	Y	Y
Gnuplot	Y?	Y	N	В	С	Y	Y	Y?	Y?	Y
HIPPODR AW	Y?	Y	N?	B??	J	Y	Y?	Y	Y	Y
JAS	Y?	Y/no 3-D	N	В	J	Y	Y?	Y	Y	Y
PAW	?	Y	N	В	F	Y	Y	Y?	Y	
QDP	N	Y	Y?	Е	F	Y- Win?	Y	Y?	Y	Y
ROOT	Y	Y	N?	В	С	Y	Y	Y	Y	Y
Plotting and Image										
Chaco	Y?	N	?	В	O =Py	Y	Y	Y?	Y	Y
ChIPs	N	Y	Y	Е	O= <sub>S</sub> - lang	N	Y	Y?	Y	Y
ESO- MIDAS	N?	Y	Y	Е	L,F,	N	Y	Y	Y	Y
NCAR_gr aohics	N?	Y	Y	В	C,F	Cyg Win?	Y	Y	Y	Y
Pdl	Y	Y	Y	В	O= Perl	Y?	Y	Y?	Y	Y
Pgplot		Y	Y?	L	C,F	N Win?	Y	Y	Y	Y
Plplot		Y	Y?	L	C,F, O= Tcl	Y	Y?	Y	Y	Y
Plt/wxPyt hon	Y	Y	Y	В	O =Py	Y	Y	Y?	Y	Y
Image/gra phic tools										

AstroMD	Y	N	Y	В	C	Y	N?	Y?	Y	Y
Ds9	N - Tcl	N	Y	Е	O= XPA	N-Sol	Y	Y	Y	Y
FOX	Y	N	Y	L	С	Y	Y	Y	?	?
Fv/ POW	?	Y/no 3-D	Y	В	O= Tcl	Y	Y	Y?	Y	Y
Qt	Y	N	Y	L	C	Y	Y	Y	Y?	?
VisAD	Y	Y	Y	L	С	Y	Y	Y	Y	?
VTK	Y	Y?	Y	L	С	Y	Y	Y	Y	?
Xforms	Y	No 3d or cont	Y	L	С	N	Y	Y	Y	Y
ximage		N	Y	Е	L	N (Win)	Y	Y	Y?	?
key	Good	Bad								

## Package Information:

Line Plot based

Dataplot

http://www.itl.nist.gov/div898/software/dataplot/

gnuplot

http://www.gnuplot.info/

Note there is a Qt front end for GNUplot: <a href="http://www.flash.net/~dmishee/xgfe/xgfe.html">http://sourceforge.net/projects/gnuplot/</a>

Grace

http://plasma-gate.weizmann.ac.il/Grace/

hippodraw

http://www.slac.stanford.edu/grp/ek/hippo/

JAS - Java Analysis Studio

http://www-sldnt.slac.stanford.edu/jas

PAW - Physics Analysis Workstation? -

http://wwwinfo.cern.ch/asd/paw/

 $\frac{QDP}{http://heasarc.gsfc.nasa.gov/docs/software/ftools/others/qdp/node3.html} \ (frontend for PGPLOT) \ (frontend for PGPL$ 

ROOT - ROOT Analysis package -

http://root.cern.ch

Both Line Plot and Image manipulation

Chaco

http://www.scipy.org/site content/chaco

Requires wxPython and Numeric (Python)

#### ChiPS Chandra Plotting and Image Manipulation Tool

http://cxc.harvard.edu/ciao/download/doc/chips html manual/index.html

#### **ESO-MIDAS**

http://www.eso.org/projects/esomidas/

NCAR\_Graphics - http://ngwww.ucar.edu/ng4.2/

## PDL - The PERL data Language

http://pdl.perl.org/

#### **PGPLOT**

http://www.astro.caltech.edu/~tjp/pgplot/

#### Plplot

http://plplot.sourceforge.net/

## wxPython/SciPy/plt

http://www.wxpython.org/

http://www.scipy.org

http://www.scipy.org/site content/tutorials/plot tutorial

### Image Manipulation programs

AstroMD - Multi Dimensional visualization and analysis toolkit for astrophysics

http://www.cineca.it/astromd/

## ds9 - Astronomical Data Visualization Application

http://hea-www.harvard.edu/RD/ds9/

### FOX

http://www.fox-toolkit.org

### fv/POW - FITS viewer

http://heasarc.gsfc.nasa.gov/docs/software/ftools/fv/

Qt - http://www.trolltech.com

## **VISAD**

http://www.ssec.wisc.edu/~billh/visad.html

#### VTK

http://public.kitware.com/VTK

#### Xforms

http://world.std.com/~xforms/

### ximage

http://heasarc.gsfc.nasa.gov/docs/xanadu/ximage/ximage.html

## Not listed:

 $\begin{array}{l} SAL - Scientific \ Data \ Processing \ \& \ Visualization - Software \ Packages \\ \underline{ \ http://sal.kachinatech.com/D/1/index.shtml} \\ \hline (contains links to many packages) \end{array}$ 

# Starlink – OpenDX

http://www.starlink.rl.ac.uk/star/docs/sun203.htx/sun203.html#xref

## **IRAF**

http://iraf.noao.edu

# Pros and Cons

Package	Pros	Cons
Dotanlat		
Dataplot Gnuplot	lightweight, supported	Barely publication quality,
Спиріої	Front ends many add-ons available.	Main Dataplot is an environment, A separate module handles C interface. And GUI front end. C interface not supported on Windows. Documentation is scattered. Big plans for gnuplot on sourceforge – not there yet
HIPPODRAW	Supported on all platforms, Java	Documentation??
JAS	JAS written in Java so all java library is available. Servelet capability built in.	Histogramming supported – how hard to adding contour plots, overlays, etc?
PAW		Was the precursor to ROOT, written in FORTRAN
QDP		Uses PGPLOT for graphics – why not just use PGPLOT?
ROOT	Already being used for GLAST. May add image display capability and FITS IO for INTEGRAL	BIG package to ask people to install.
Chaco	Under development with HST we have a chance to influence directions. Plan is to include image manipulation and plotting.	Limited capability now – based on wxPython. No contour plots or histograms. Need to understand better why we would want to use Chaco and not wxPython/SciPy, which already works.
ESO-MIDAS		
NCAR_graohics		
Pdl	Written in PERL	Complicated dependency for windows? Maybe this is automatically handled by the install package?
Pgplot	Provides all basic functionality Long history	Graphs are not as pretty as we would like Not native C or C++ No support for Windows.
Plplot	Looks like PGPLOT with windows suppot. Source Forge asserts publication quality plots – Are other fonts available now? Source Forge actively improving the package.	Quality in demo plots about the same as PGPLOT Not sure it can really display images.
Plt/wxPython/Sci Py	Handles image manipulation, 2D graphics and widgets.	Does not do contour plots or histograms.  Do we really want our whole plotting package API in Python? Full 3D graphics possible with VTK – why not skip the middleman and use VTK?
AstroMD	No built in line plots	Needs VTK based on OpenGL toolkit
Ds9	•	1
FOX	Great GUI toolkit, meant to perform	Plotting part must be written
Fv/	Tcl/Tk-based, and therefore supported on	POW lifetime unknown, will need XPA
POW	all platforms,	to interface to C, C++, Fortran
Qt	Great GUI Toolkit	No Plotting, Free Qt for Windows not up

		to most recent version
VISAD	Can do 3D manipulations,	More than we really need?
	Communication interface built in	
VTK	Complete toolkit	More than we really need?
Xforms	Simple lightweight GUI builder	Does not run on Windows
ximage		

# Criteria

- want widgets
   want C,J programming interface
   want full platform support

Package	Widg ets	Plot Type	Image Man	Pkg Type	API	Plat forms	Lif e	Dep.	Qual	Out
Plotting tools		JI.		JP						
HIPPODR AW	Y?	Y- 3D?	N?	E??	J	Y	Y?	Y	Y	Y
JAS	Y?	Y/no 3-D	N	В	J	Y	Y?	Y	Y	Y
ROOT	Y	Y	N?	В	С	Y	Y	Y	Y	Y
Plotting and Image										
Plplot	Y?	Y	Y?	L	C,F	Y	Y?	Y	Y	Y
Image/gra phic tools										
VisAD	Y	Y	Y	L	C	Y	Y	Y	Y	?
VTK	Y	Y?	Y	L	С	Y	Y	Y	Y	?
key	Good	Bad								