

Scriptable Plotting in STILTS

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Introduction

STILTS is a command-line package for doing stuff with tables (TOPCAT's non-GUI evil twin)

- format conversion
 - data/metadata access and manipulation
 - crossmatching
 -
- . . . and now plotting

STILTS plotting use cases (as opposed to TOPCAT):

- Comparison of multiple similar datasets
- Reproduce same/similar plots in different sessions
- Plots for publication?
- Plot generation in third-party software components
- Server-side plot generation (serve graphics, not raw data)
- Plot very large data sets ($\gg 10^6$ rows)

Current Status

● STILTS 2.0b

- Released 23 Oct 2008
- Plotting:
 - ▷ Plot types available: `plot2d`, `plot3d`, `plothist`
- Server/servlet mode:
 - ▷ Useful (but not essential) for server-side plotting
 - ▷ Reduces per-invocation startup time
 - ▷ Serves plot/table types with correct HTTP headers (MIME type etc)
- Plotting and server features considered *experimental* (lurking bugs? missing features?)
- See also ADASS poster
- More info and downloads at <http://www.starlink.ac.uk/stilts/>

● Future releases

- Other plot types (spherical, density map, stacked line plot)
- Better configurability of plot appearance
- Better TOPCAT interoperability for plotting
- Response to user requests?

Features

- Aim to provide all the options of TOPCAT:
 - Highly configurable plotting styles
 - Symmetric or asymmetric N-dimensional error bars/ellipses/cuboids/. . .
 - Auxiliary (colour) axes
 - Variable transparency
 - Text labelling of points
 - Explicit or automatic range setting
 - On-the-fly data modification prior to plotting
 - Choice of output formats (EPS, PNG, GIF, JPEG or to screen)
- . . . and then some:
 - More configurability (font size/style, colour choice, axis labelling, . . .)
 - Streamed input → unlimited dataset size

Interface

- It does look a bit complicated:

```
Usage: plot2d xpix=<int-value> ypix=<int-value> font=dialog|serif|... fontsize=<int-value>
fontstyle=plain|bold|italic|bold-italic title=<value> omode=swing|out|cgi|discard|auto
out=<out-file> ofmt=png|gif|jpeg|eps|eps-gzip inN=<table> ifmtN=<in-format> istreamN=true|false
cmdN=<cmds> xdataN=<expr> ydataN=<expr> auxdataN=<expr> xlo=<float-value> ylo=<float-value>
auxlo=<float-value> xhi=<float-value> yhi=<float-value> auxhi=<float-value> xlog=true|false
ylog=true|false auxlog=true|false xflip=true|false yflip=true|false auxflip=true|false
xlabel=<value> ylabel=<value> auxlabel=<value> xerrorN=<expr>| [<lo-expr>], [<hi-expr>]
yerrorN=<expr>| [<lo-expr>], [<hi-expr>] auxshader=rainbow|pastel|...
txtlabelN=<value> subsetNS=<expr> nameNS=<value> colourNS=<rrggbb>|red|blue|...
shapeNS=filled_circle|open_circle|... sizeNS=<int-value> transparencyNS=<int-value>
lineNS=DotToDot|LinearRegression hideNS=true|false errstyleNS=lines|capped_lines|...
grid=true|false antialias=true|false sequence=<suffix>,<suffix>,...
```

- but simple use is straightforward

```
stilts plot2d in=cat.xml xdata=RMAG ydata=BMAG-RMAG
```

- and there is extensive help

- reference/tutorials/examples in the manual ([HTML](#) or [PDF](#))
- command-line help

```
stilts plot2d help
```

```
stilts plot2d help=<param-name>
```

Command-line Help

```
% stilts plot2d help=omode
```

```
Help for parameter OMODE in task PLOT2D
```

```
-----
```

```
Name:
```

```
omode
```

```
Usage:
```

```
[omode=swing|out|cgi|discard|auto]
```

```
Summary:
```

```
Mode for graphical output
```

```
Description:
```

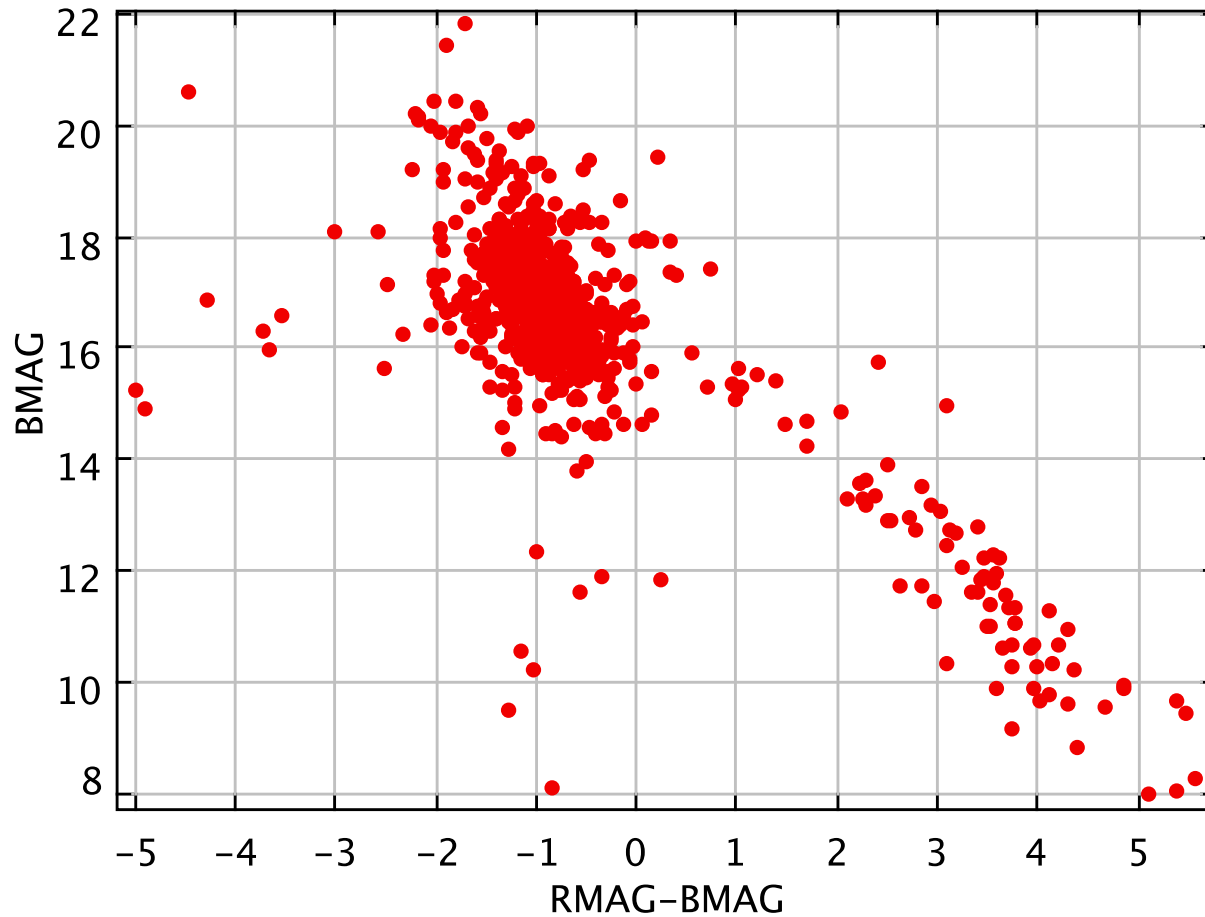
```
Determines how the drawn plot will be output.
```

- * swing: Plot will be displayed in a window on the screen.
- * out: Plot will be written to a file given by out using the graphics format given by ofmt.
- * cgi: Plot will be written in a way suitable for CGI use direct from a web server. The output is in the graphics format given by ofmt, preceded by a suitable "Content-type" declaration.
- * discard: Plot is drawn, but discarded. There is no output.
- * auto: Behaves as swing or out mode depending on presence of out parameter

```
Default:
```

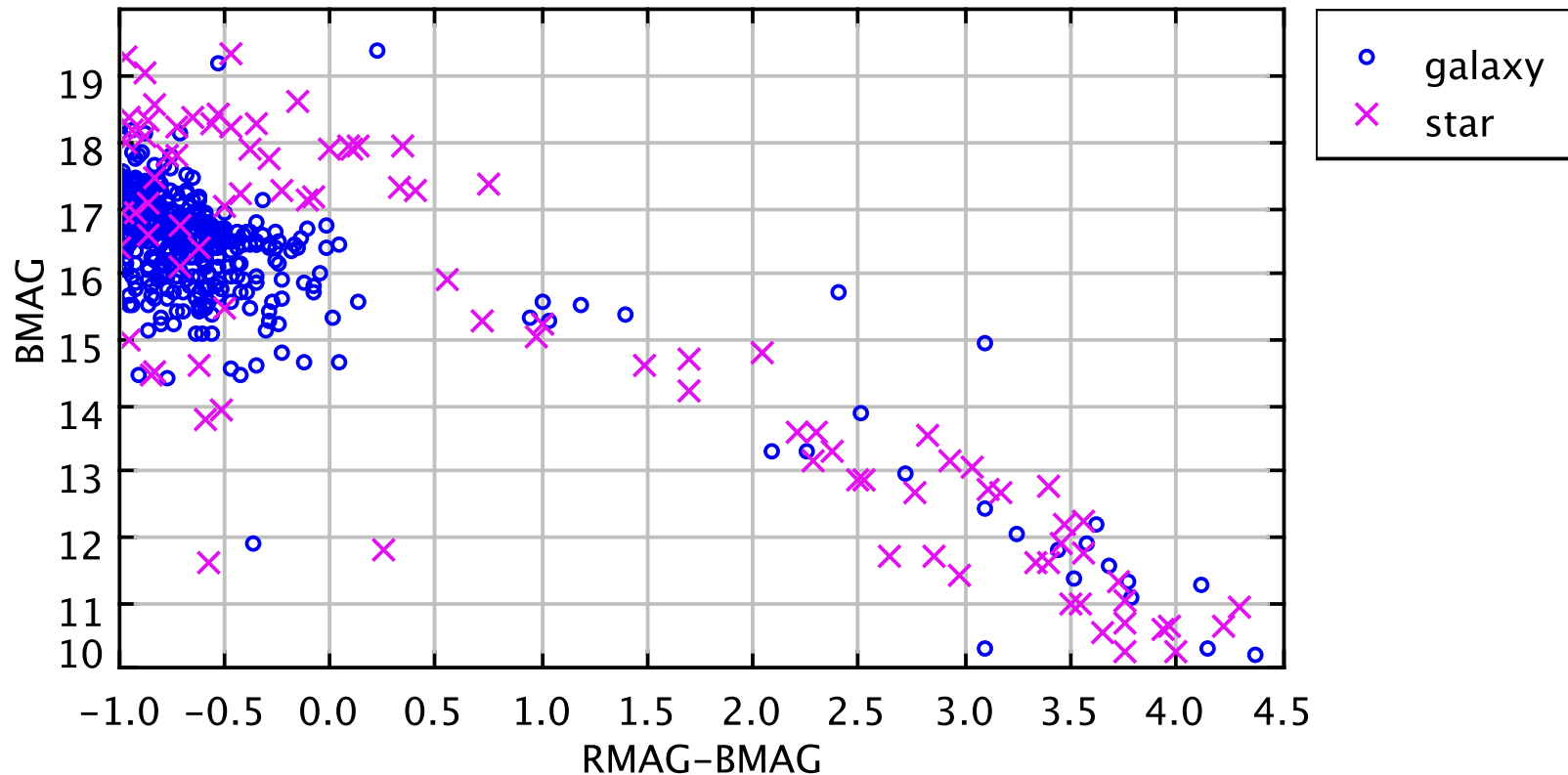
```
auto
```

Examples



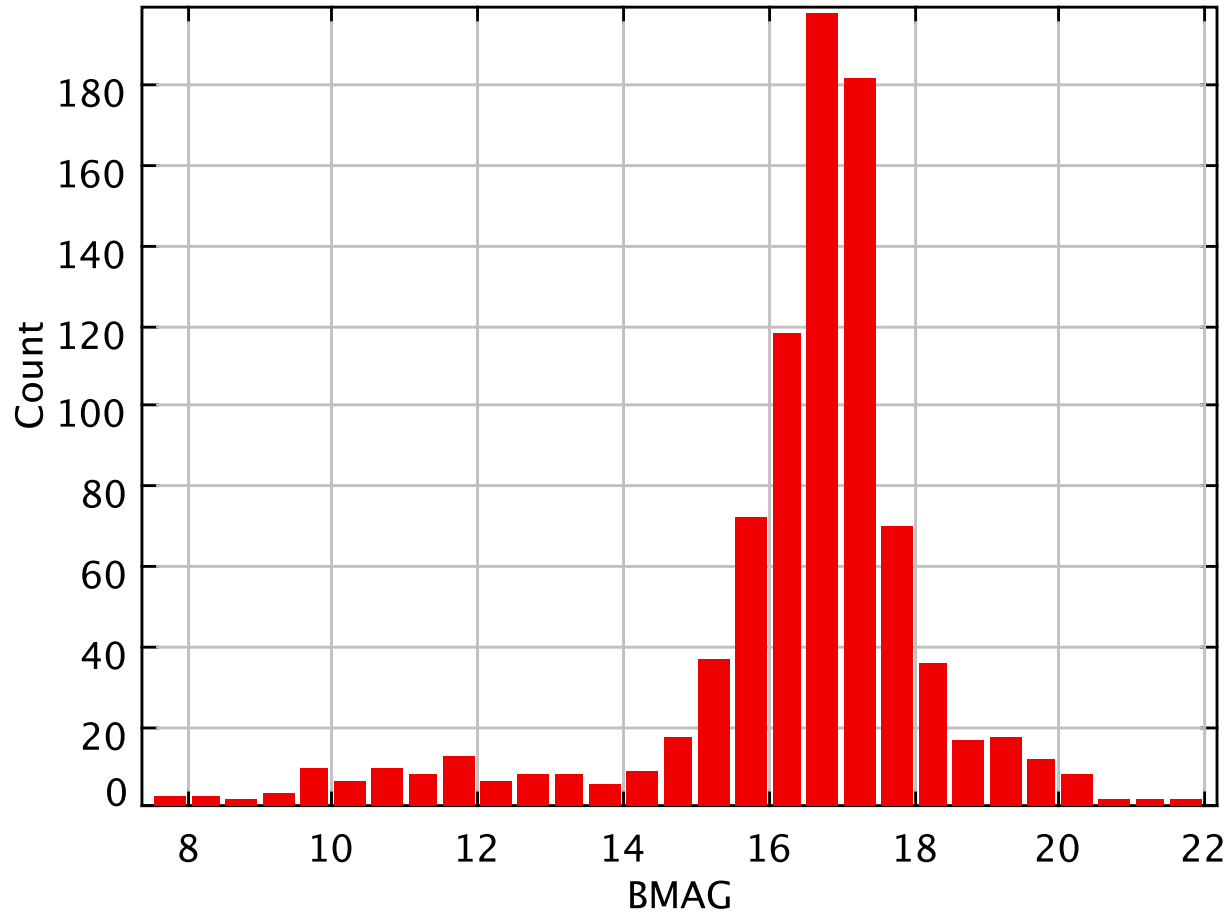
```
stilts plot2d in=cat.xml  
xdata=RMAG-BMAG ydata=BMAG  
out=color-mag.eps
```

Examples



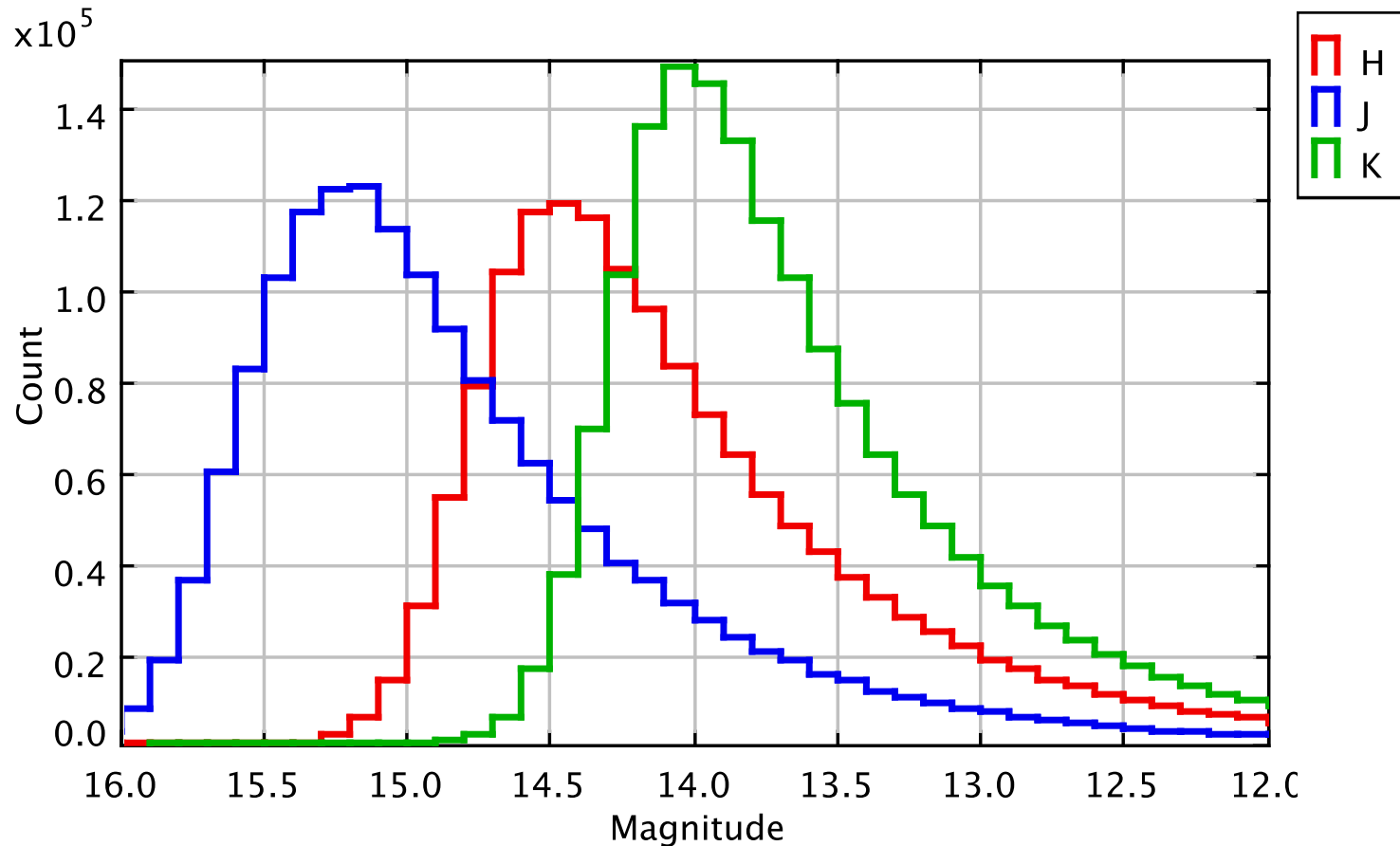
```
stilts plot2d in=cat.xml
          xdata=RMAG-BMAG ydata=BMAG
          subset1=SGFLAG==1 name1=galaxy colour1=blue shape1=open_circle
          subset2=SGFLAG==2 name2=star colour2=e010f0 shape2=x size2=3
          xlo=-1 xhi=4.5 ylo=10 yhi=20
          xpix=500 ypix=250
          out=color-mag2.eps
```


Examples



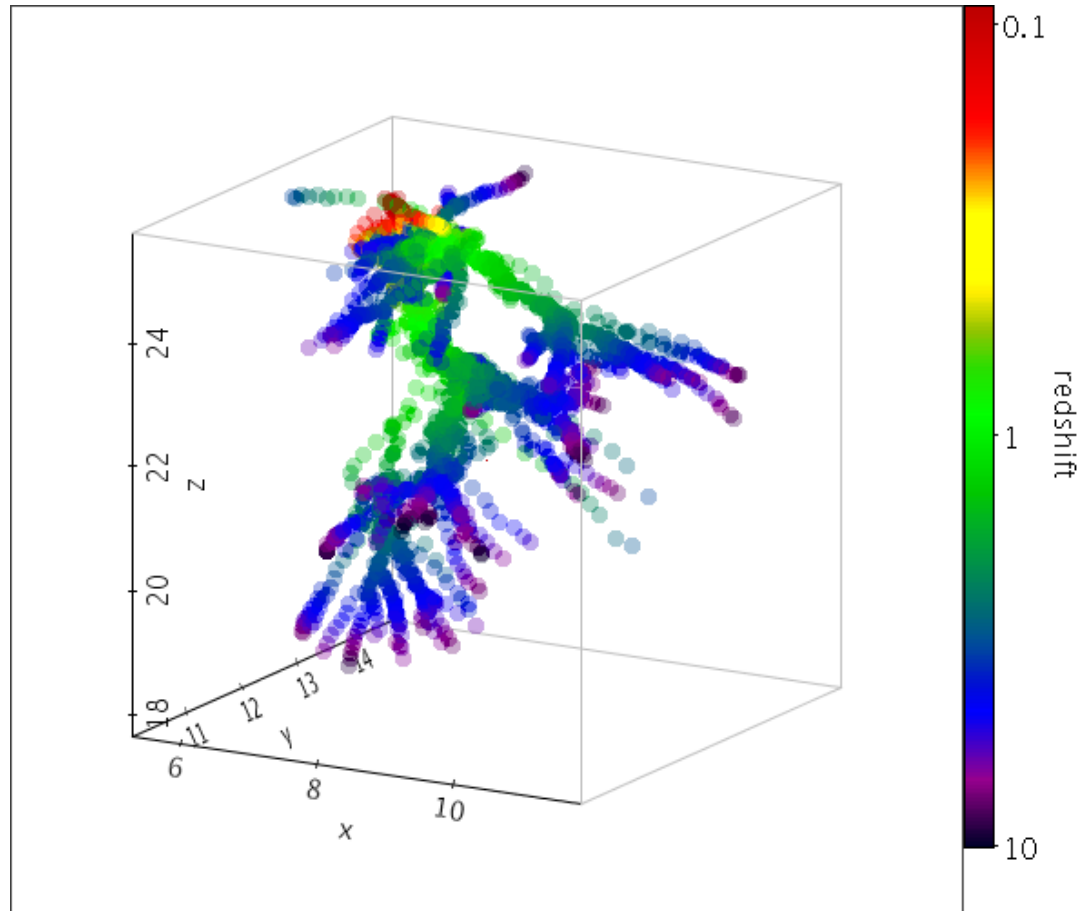
```
stilts plothist in=cat.xml  
xdata=BMAG  
out=maghist.eps
```

Examples



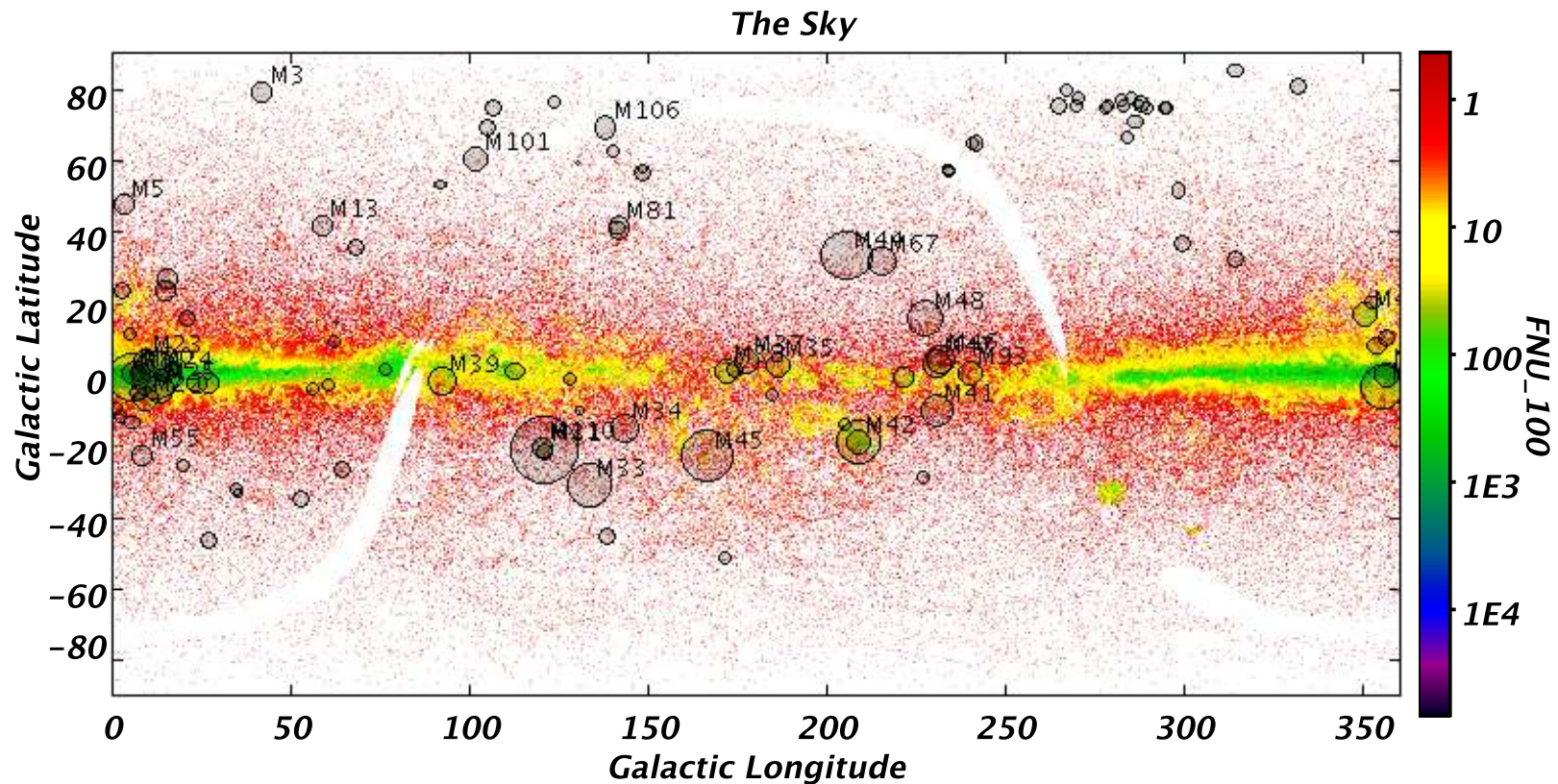
```
stilts plothist inJ=2mass_xsc.fits xdataJ=j_m_k20fe barstyleJ=tops
inH=2mass_xsc.fits xdataH=h_m_k20fe barstyleH=tops
inK=2mass_xsc.fits xdataK=k_m_k20fe barstyleK=tops
binwidth=0.1 xlo=12 xhi=16 xflip=true xlabel=Magnitude xpix=500
out=2mass.eps
```

Examples



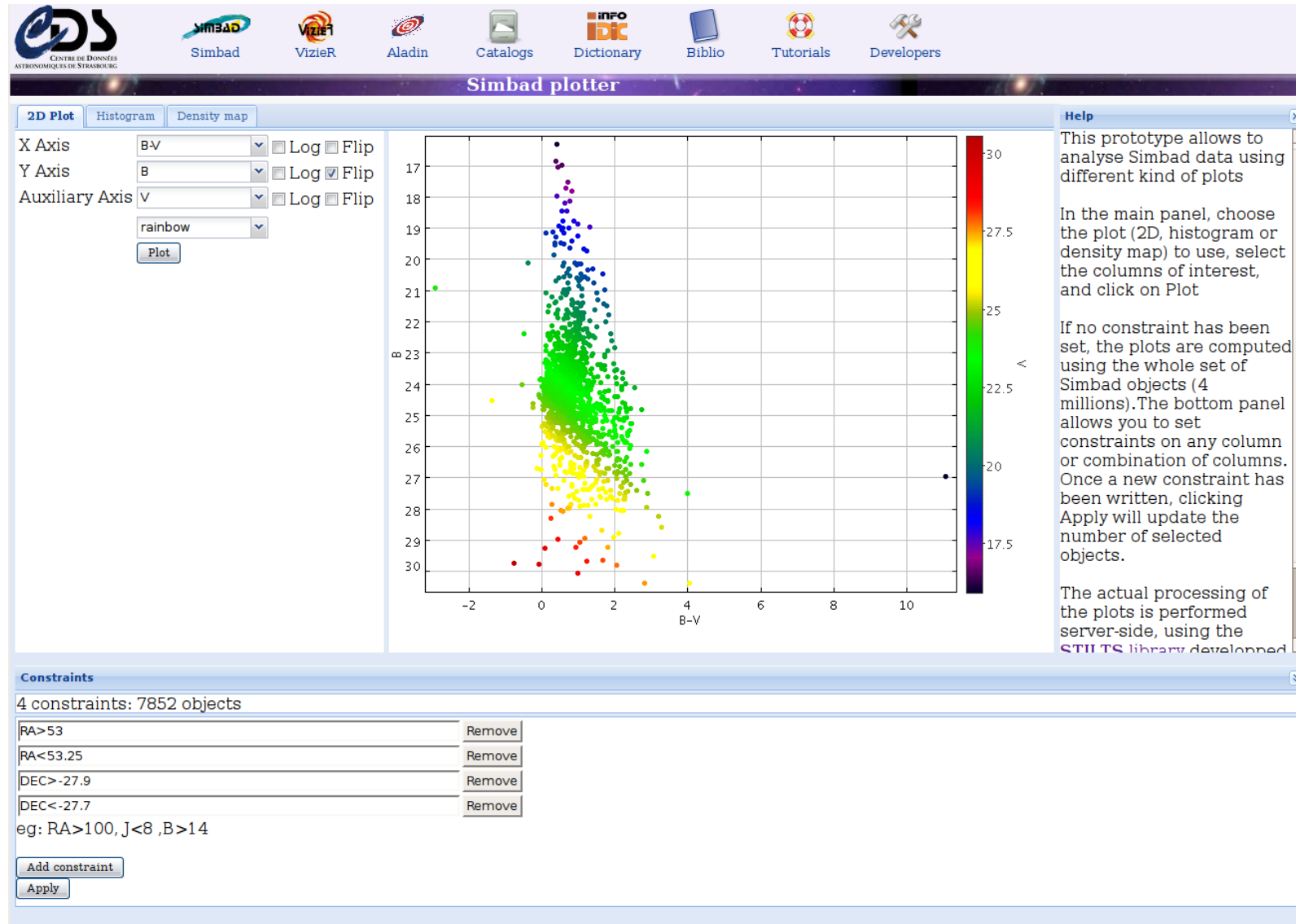
```
stilts plot3d in=gavo_g2.fits  
xdata=x ydata=y zdata=z  
auxdata=redshift auxlog=true auxflip=true transparency=3  
size=4 fog=0 out=xyz.png
```

Examples



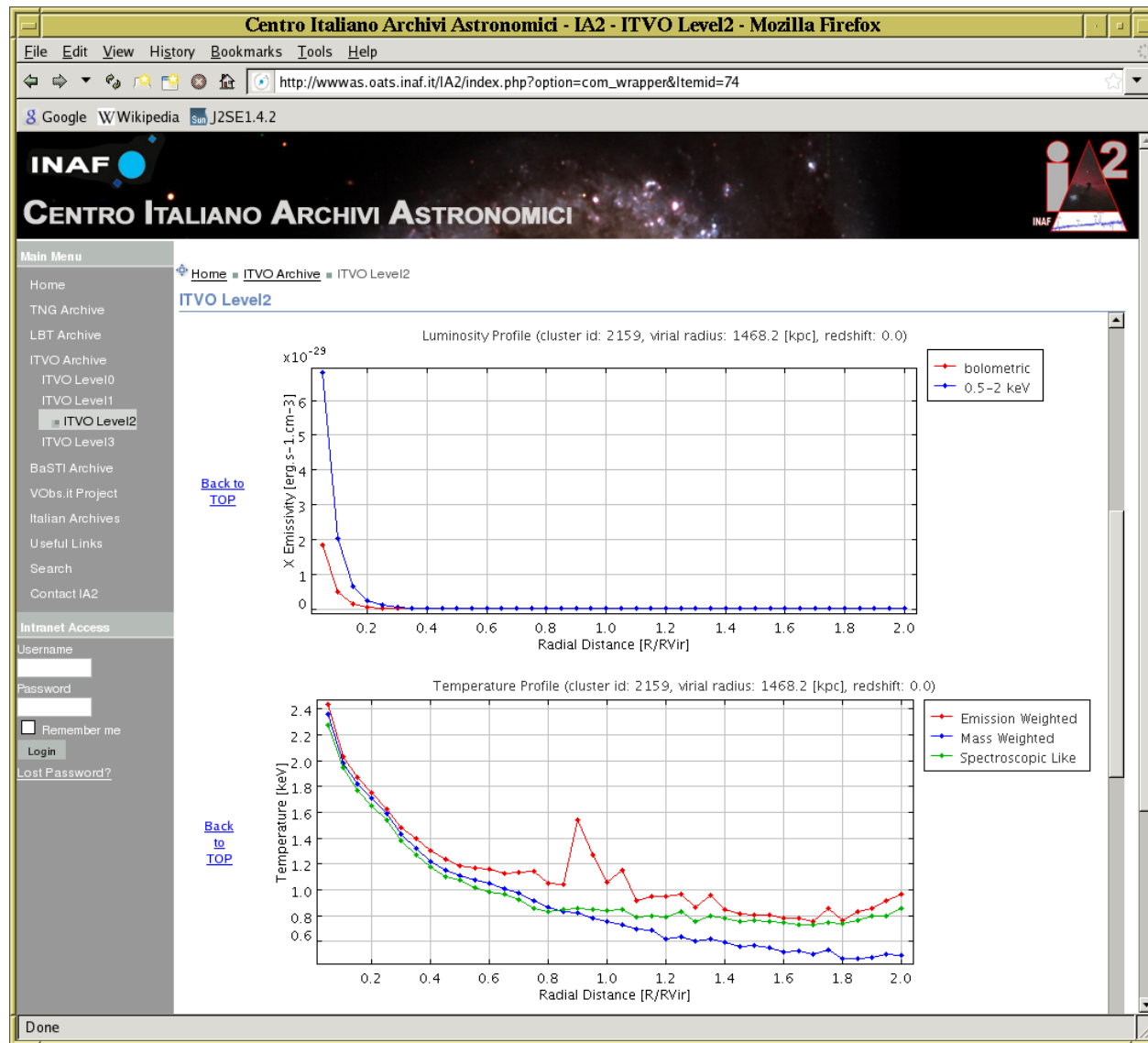
```
stilts plot2d in1=iras_psc.fits cmd1='addskycoords fk5 galactic RA DEC GLON GLAT' xdata1=GLON ydata1=GLAT
auxdata1=FNU_100 auxlog=true auxflip=true size1=0 transparency1=3
in2=messier.xml cmd2='addskycoords fk5 galactic RA DEC GLON GLAT' xdata2=GLON ydata2=GLAT
txtlabel2=RADIUS>16?("M"+ID):"" cmd2='addcol SIZE sqrt(RADIUS/2)' xerror2=SIZE yerror2=SIZE
subset2a=true hide2a=true colour2a=black errstyle2a=ellipse
subset2b=true hide2b=true colour2b=black errstyle2b=filled_ellipse transparency2b=6
xlabel='Galactic Longitude' ylabel='Galactic Latitude' title='The Sky' legend=false grid=false
xlo=0 xhi=360 ylo=-90 yhi=+90 xpix=800 ypix=400 fontsize=16 fontstyle=bold-italic
out=skyplot.eps
```

Deployment at CDS



Thanks to Thomas Boch, CDS.

Deployment at ITVO



Thanks to Marco Molinaro, INAF/OATs.

Yet Another Plotting Package?

Why use STILTS not Gnuplot, PONGO, IDL, . . . ?

- Well, you don't have to of course.
- Reasons you might want to:
 - ▷ Direct use of STIL-friendly formats (VOTable, FITS, CSV, SQL, . . .)
 - ▷ Very large datasets (not memory-limited)
 - ▷ Complementary use with TOPCAT (*to be improved*)
 - ▷ Ease of installation, deployment and licensing

Embedded use from other Java applications possible too

- not exactly part of current public API, but wouldn't be too hard