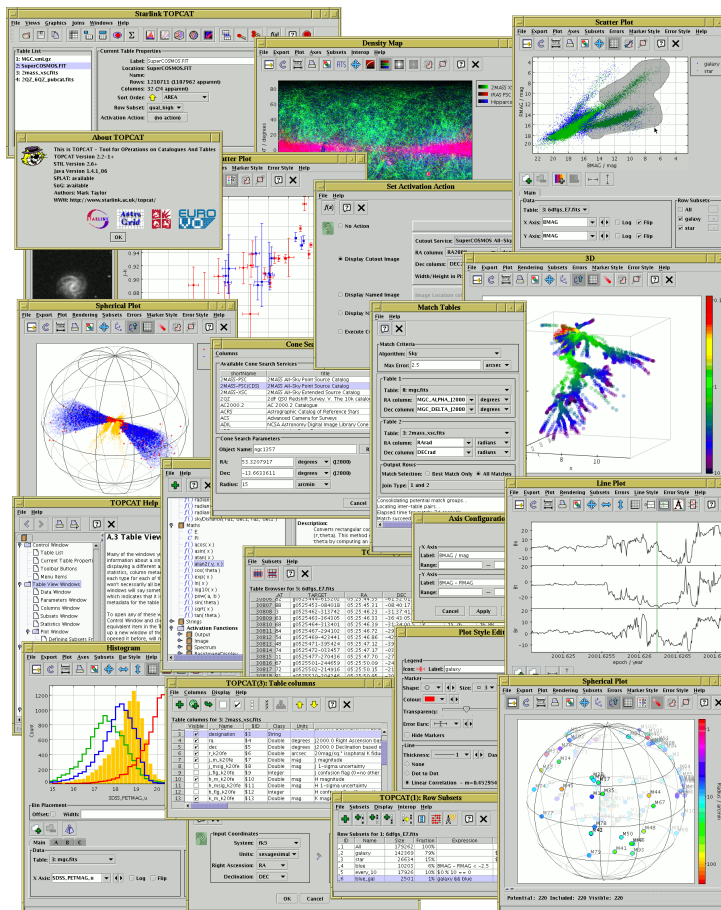# New Features in TOPCAT v3

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Outline

Recap

- What is TOPCAT?
- Exising visualisation features in TOPCAT v2

New Visualisation Features

- Reorganisation of plot windows
- Error bars
- Auxiliary (colour) axes
- Text labels
- Histogram weighting
- Density plot colour maps

New VO Features

- Expression language enhancments (UCD-related)
- Load dialogue for GAVO Millennium Simulation database

Other New Features

- Statistics window additions

Recap: What is **TOPCAT?**

Analysis/manipulation for tabular data (e.g. astronomical catalogues)

Interactive graphical interface

- Easy to use
- Powerful features
- Encourages interactive exploaration of data

Aims to do the things that astronomers want to do with tables

- View/edit data and metadata
- Make, compare, manipulate row selections
- Add, remove, rearrange columns
- Powerful crossmatching features
- Several visualisation windows
- Calculate statistics

Supports most important astronomical data formats

- FITS, VOTable, SQL, CSV, . . .

Supports large data sets (millions of rows, hundreds of columns)

Recap: **Visualisation Features in TOPCAT v2**

Several types of plot available

- Histogram
- 2-d Scatter Plot
- 3-d Scatter Plot
- Spherical (sky) plot with optional radial coordinates
- Density Map (2-d histogram)
- Stacked line plot

Plot windows share common features

- Specify columns or expressions as coordinates
- Interactive zoom/rotate
- Select single points/regions and view in other plots
- Highly configurable plot symbol appearance
- View multiple datasets on the same plot
- Export to GIF/JPEG/publication-quality EPS
- Variable plotting transparency for crowded plots
- Fast drawing (millions of points in a few seconds)

Plot Window Reorganisation

Some changes to the layout and functionality of all plot windows

- Separate toolbar near bottom for dataset selector
  - ▷ Configures options for optional data axes
  - ▷ Error values, Auxiliary axes, Text labels, . . .

- Resize option for dataset selector
  - ▷ Can provide more space for plots on limited screen sizes

- Better legend configurability
  - ▷ Hide/show legend
  - ▷ Hide/show individual entries in legend
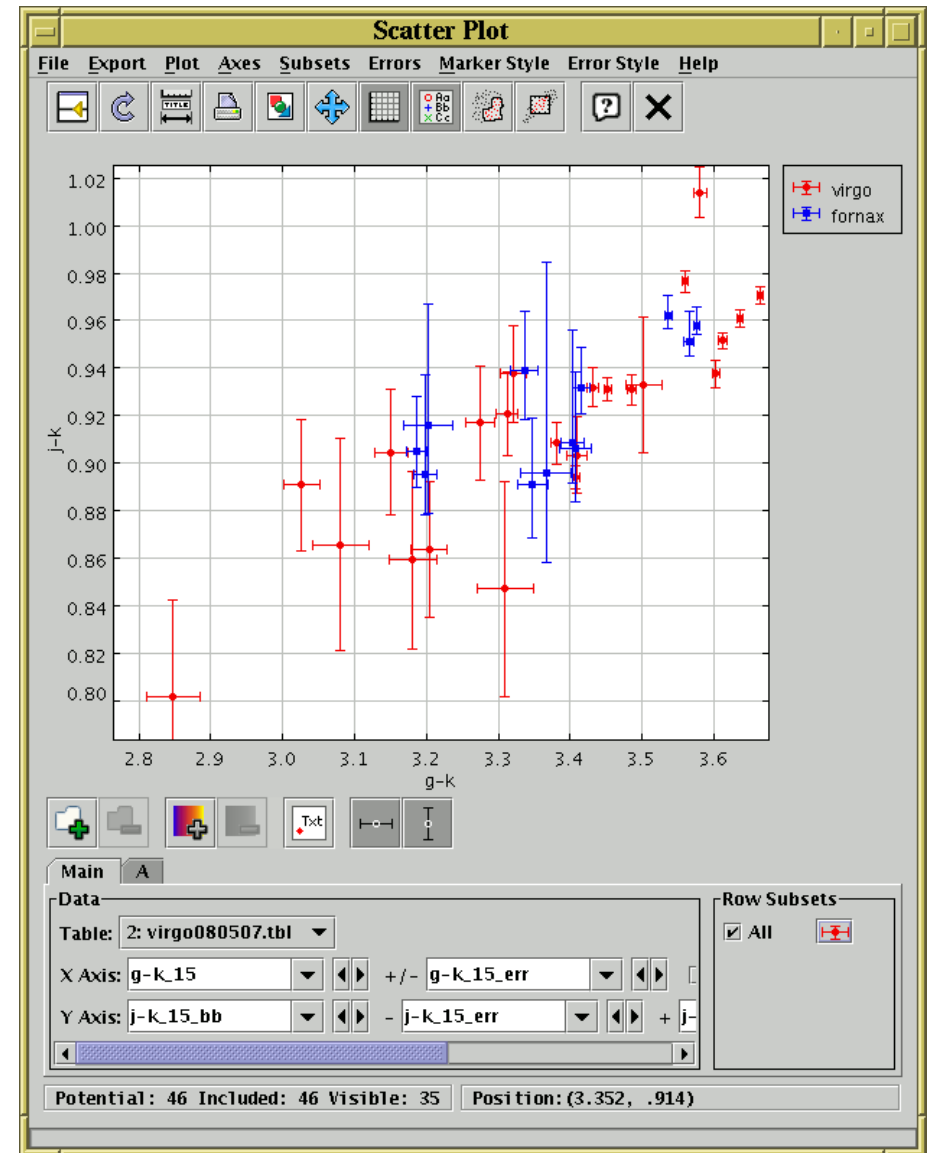 - ▷ Useful when generating plots for publication

Error Bars

Error bars can be drawn in all 2D and 3D scatter plots

Draw errors in any or all axes

Errors can be symmetric, one-sided or asymmetric
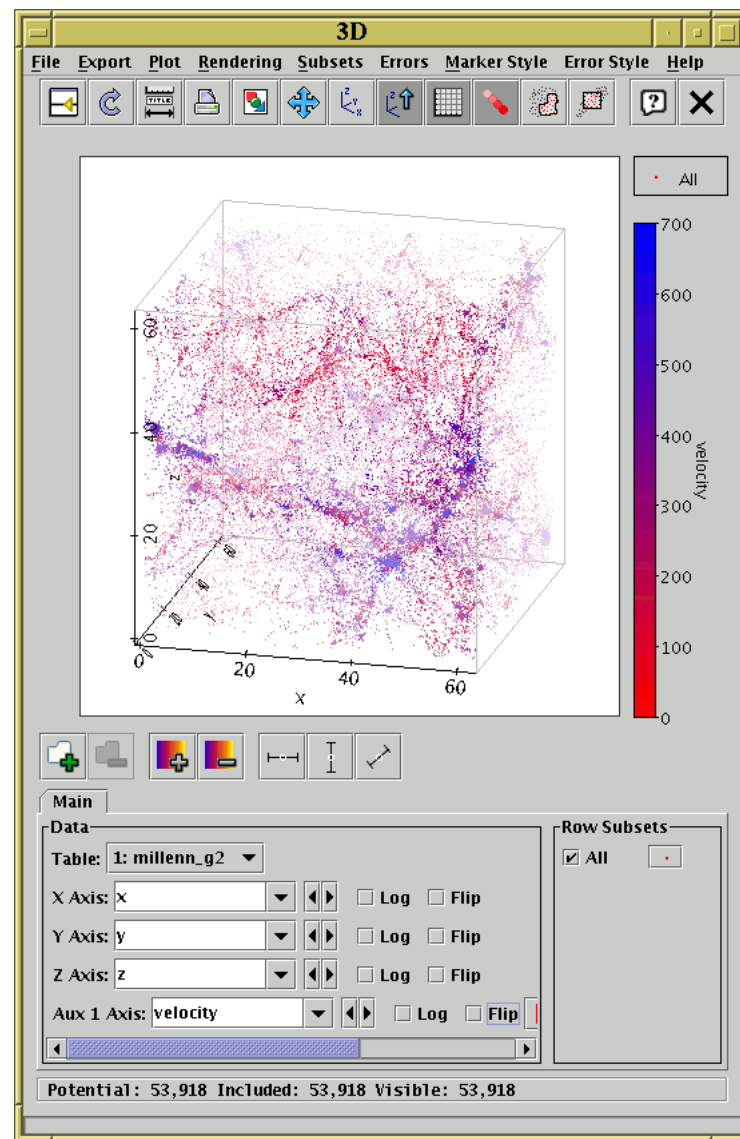
Many error style options

Auxiliary Axes

Aux axes let you modify the way points are plotted according to a selected quantity

- Usually this means setting point colour . . .

- . . . but can also modify appearance
    - ▷ transparency, intensity, hue, saturation etc.
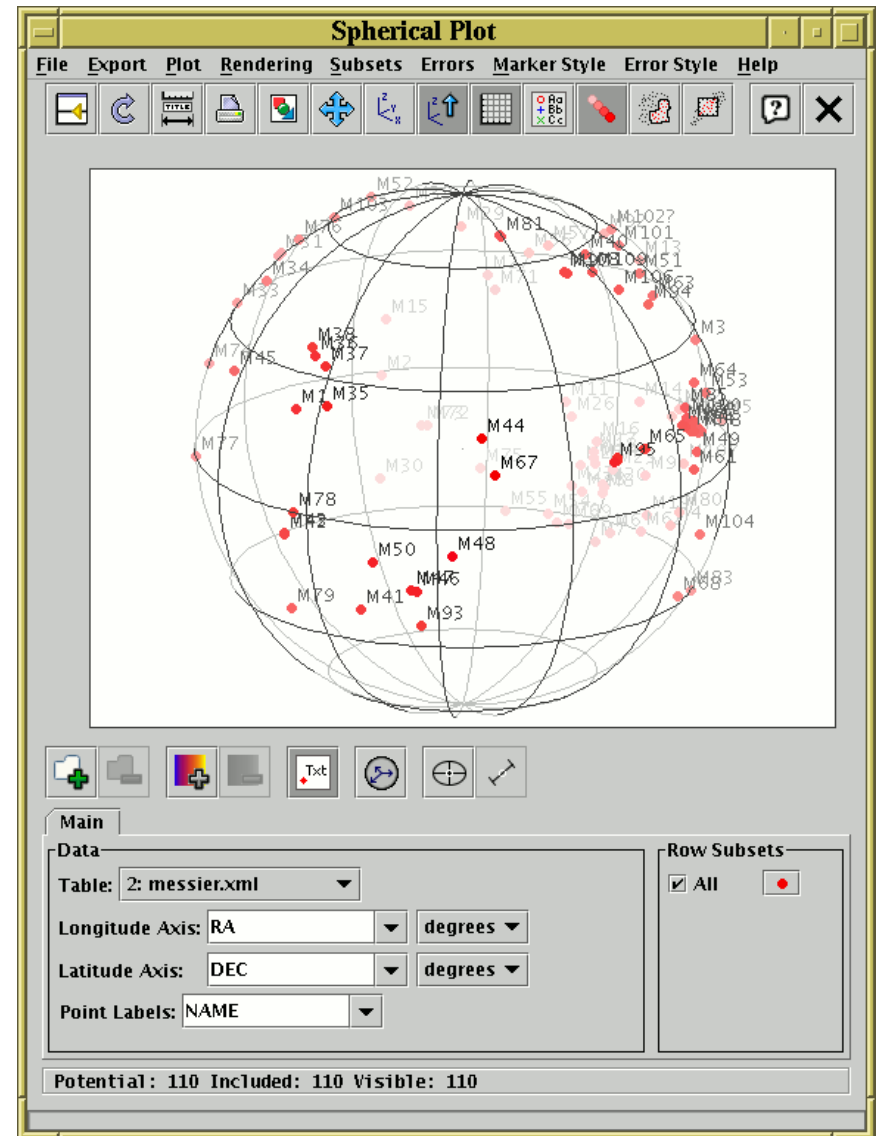   - ▷ can in principle combine these effects

This effectively gives you extra visualisation dimensions

Text Labels

Points can be labelled on any 2D or 3D scatter plot

Designate any column or function to provide label text

Histogram/Density Map Enhancements

Weighting can be applied to 1-d and 2-d histograms

- Weight value can be any column or function of columns

- Bin values are sum of given quantity rather than just counts

- Allows, for example, calculation/visualisation of binned total flux

2-d histogram (density map) has selectable colour maps

1-d histogram now allows export of result as bin-value table

- Either save to disk or re-import as new TOPCAT table

- Same applies to Statistics window
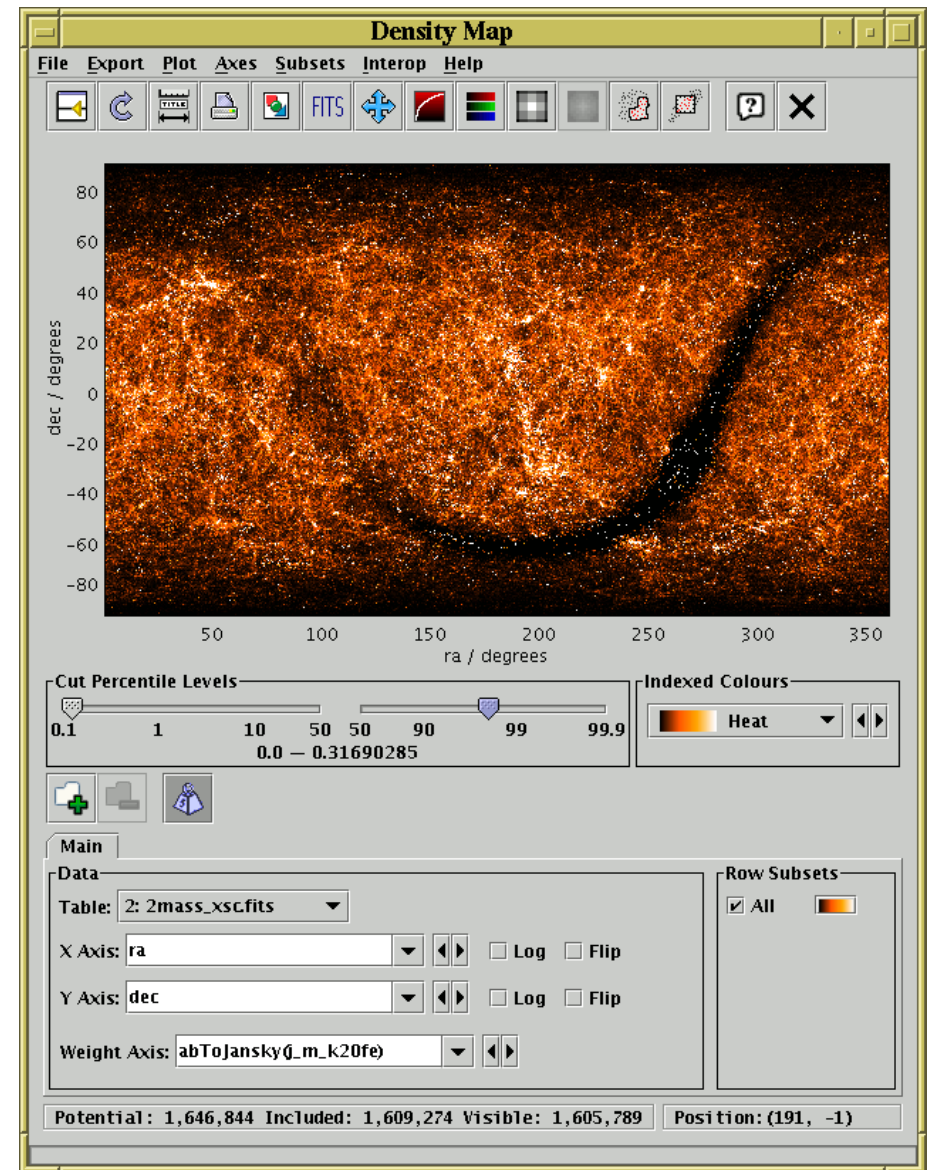
New VO Features

Reference new elements in expression language

- Refer to table parameters (VOTable `PARAM`/`INFO` elements) as `param$<name>`

- Refer to columns by UCD as as `ucd$<name>`

- Works in STILTS too

```
stilts tpipe in=cat.vot \
              cmd='keepcols "ucd$pos_eq_ra ucd$pos_eq_dec"' \
              omode=stats
```

Load dialogue for GAVO Millennium Simulation database