TOPCAT Latest
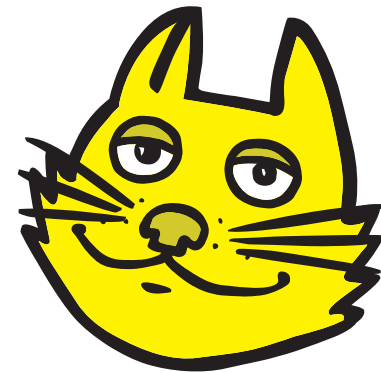
Mark Taylor (Bristol)

Applications WG session
IVOA Interop
Paris

14 May 2019

$Id: topcat.tex,v 1.19 2019/05/13 20:29:29 mbt Exp $

Outline

TOPCAT v4.6-3, STILTS v3.1-6 (9 May 2019):

- DALI Overflow indicator
- VOTable 1.4 & TIMESYS
- Region selections & ADQL expressions
- Polygon plotting
- Plot measurements
- Adaptive colour map scaling
- HEALPix improvements

http://www.starlink.ac.uk/topcat/
http://www.starlink.ac.uk/stilts/

DALI Overflow

Give indication of row overflow (or error)
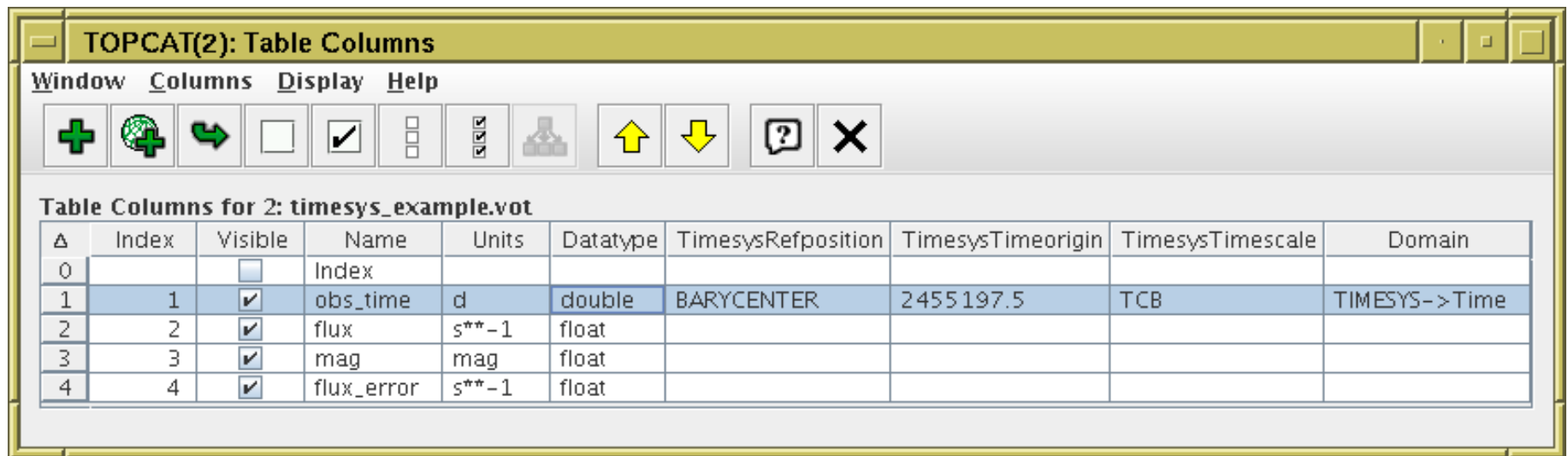
- DALI 1.1 sec 4.4.1: VOTable row count exceeding `MAXREC` or system-imposed limit:

  `<INFO name="QUERY_STATUS" value="OVERFLOW"/>`

- This is now indicated by "**(OVERFLOW)**" label in TOPCAT control window
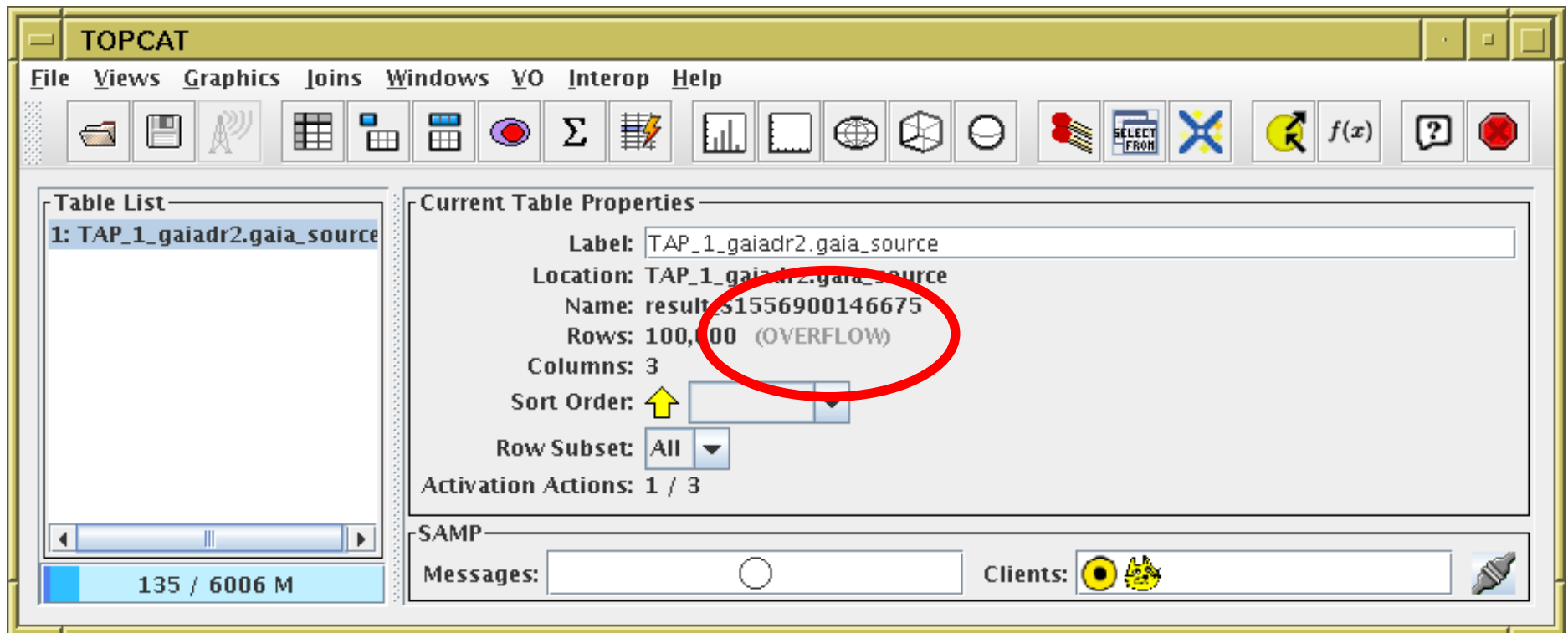
VOTable 1.4: TIMESYS Parsing

TIMESYS references mapped to STIL table model (StarTable)

- On input, FIELD→TIMESYS refs represented as column Timesys* metadata
- On output, column Timesys* metadata written as FIELD→TIMESYS refs,
  but only if -Dvotable.version=1.4 (default output version is currently 1.3)
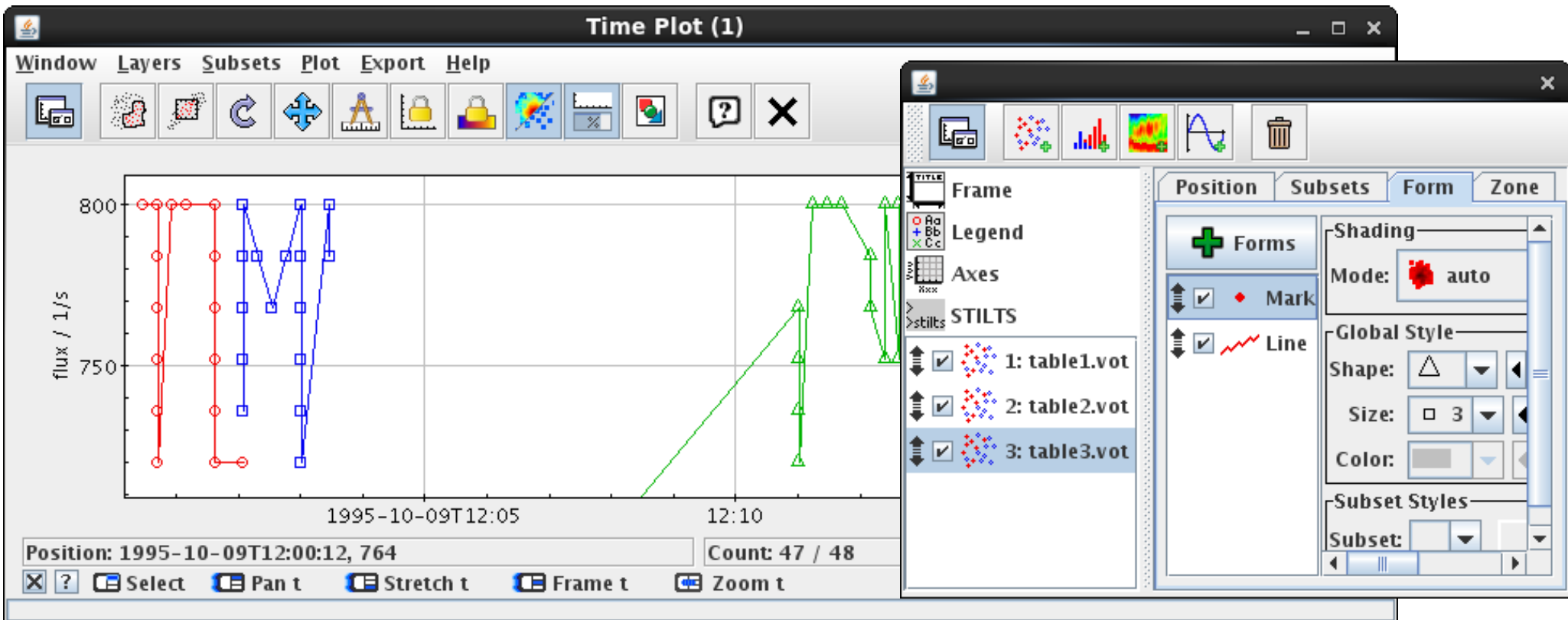- PARAM→TIMESYS refs currently ignored (STIL deficiency; fix one day?)

VOTable 1.4: TIMESYS Usage

TIMESYS values in TOPCAT/STILTS:

- Time origins/units understood
- ... but not currently much used
- So far, only used to align temporal axes in Time Plot
- No attempt to understand semantics of `refposition`, `timescale`
- Maybe more functionality in future releases

VOTable 1.4 Validation

`votlint`, hence `taplint`, updated to VOTable 1.4 WD

- Version is WD-VOTable-1.4-20190318, plus fixes to `refposition`/`timescale` URIs
- Knows (draft) VOTable 1.4 schema
- Checks TIMESYS attributes `refposition`, `timescale`
  - ▷ These attribute values are defined with reference to external *vocabularies* (e.g. `http://www.ivoa.net/rdf/timescale`)
  - ▷ Validator has hard coded list of known options (vocab contents at time of writing) (e.g. TAI, TT, UT, UTC, GPS, TCG, TCB, TDB, UNKNOWN)
  - ▷ Will read external URL at runtime in case of unrecognised value
- Warns if `TIMESYS` element is present but unreferenced

Region Selection

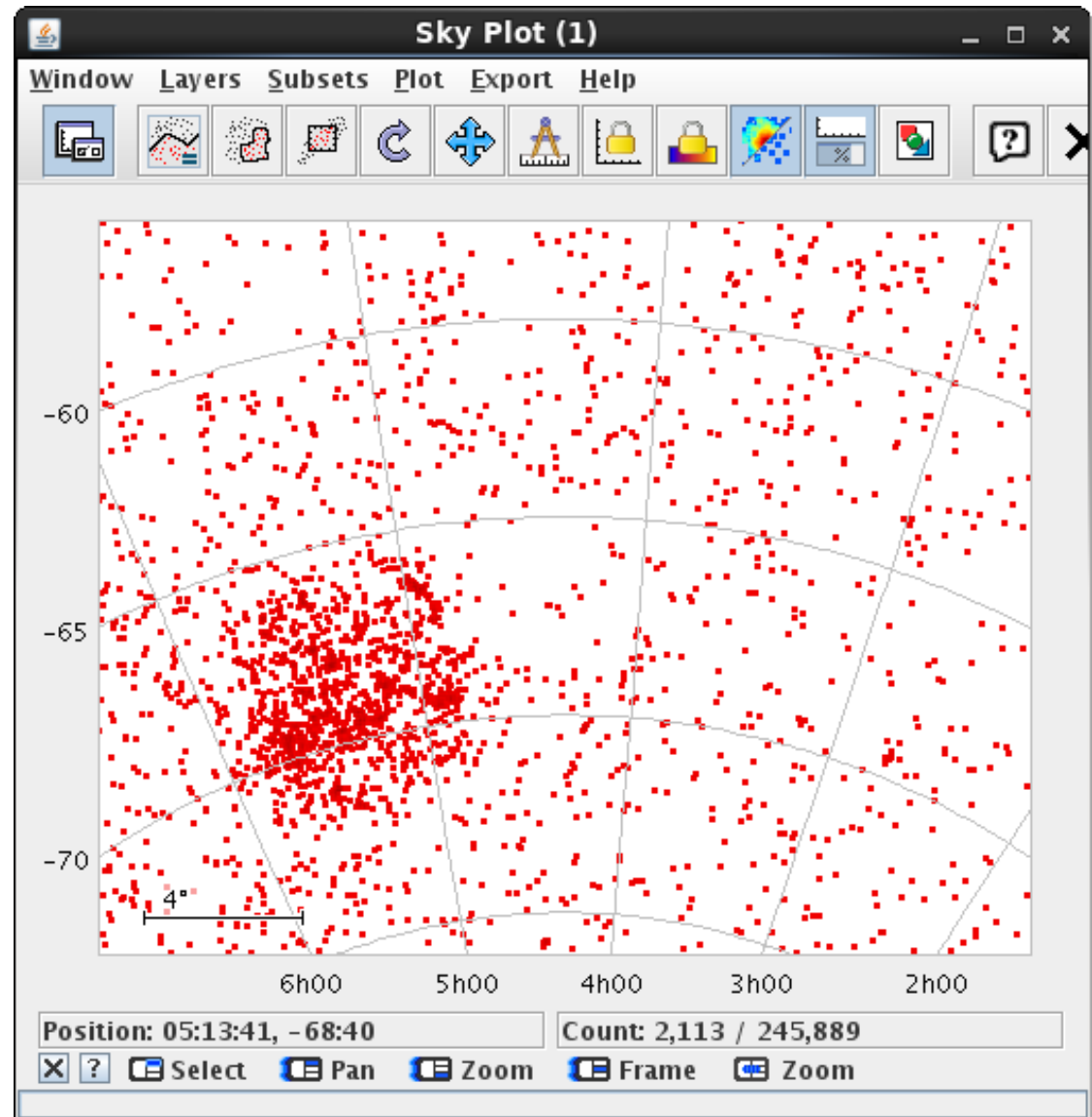More options for selecting subsets graphically

- Plane Plot: Polygon, Ellipse, Above, Below, Left, Right
- Sky Plot: Circle, Polygon

When drawing complete:

- Defines subsets
- Presents TOPCAT expression
- Presents ADQL expression
  - ▷ Sky: Circle, Polygon
  - ▷ Plane: Ellipse, Line
  - ▷ Easily pasted into TAP

Future plans:
better region support
(not just subset selections)

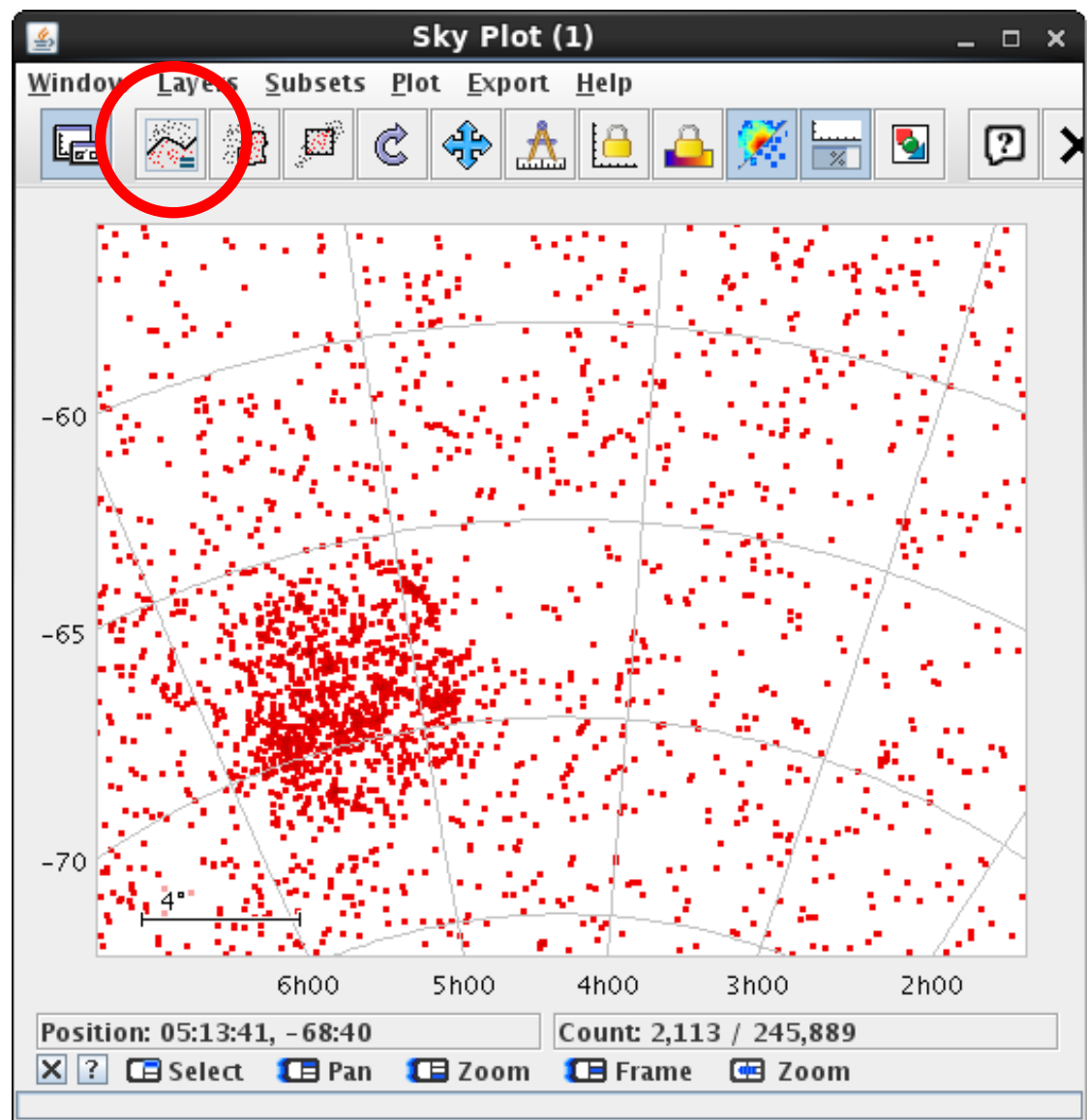# Region Selection

More options for selecting subsets graphically

- Plane Plot: Polygon, Ellipse, Above, Below, Left, Right
- Sky Plot: Circle, Polygon

When drawing complete:

- Defines subsets
- Presents TOPCAT expression
- Presents ADQL expression
  - ▷ Sky: Circle, Polygon
  - ▷ Plane: Ellipse, Line
  - ▷ Easily pasted into TAP

Future plans:
better region support
(not just subset selections)

Region Selection

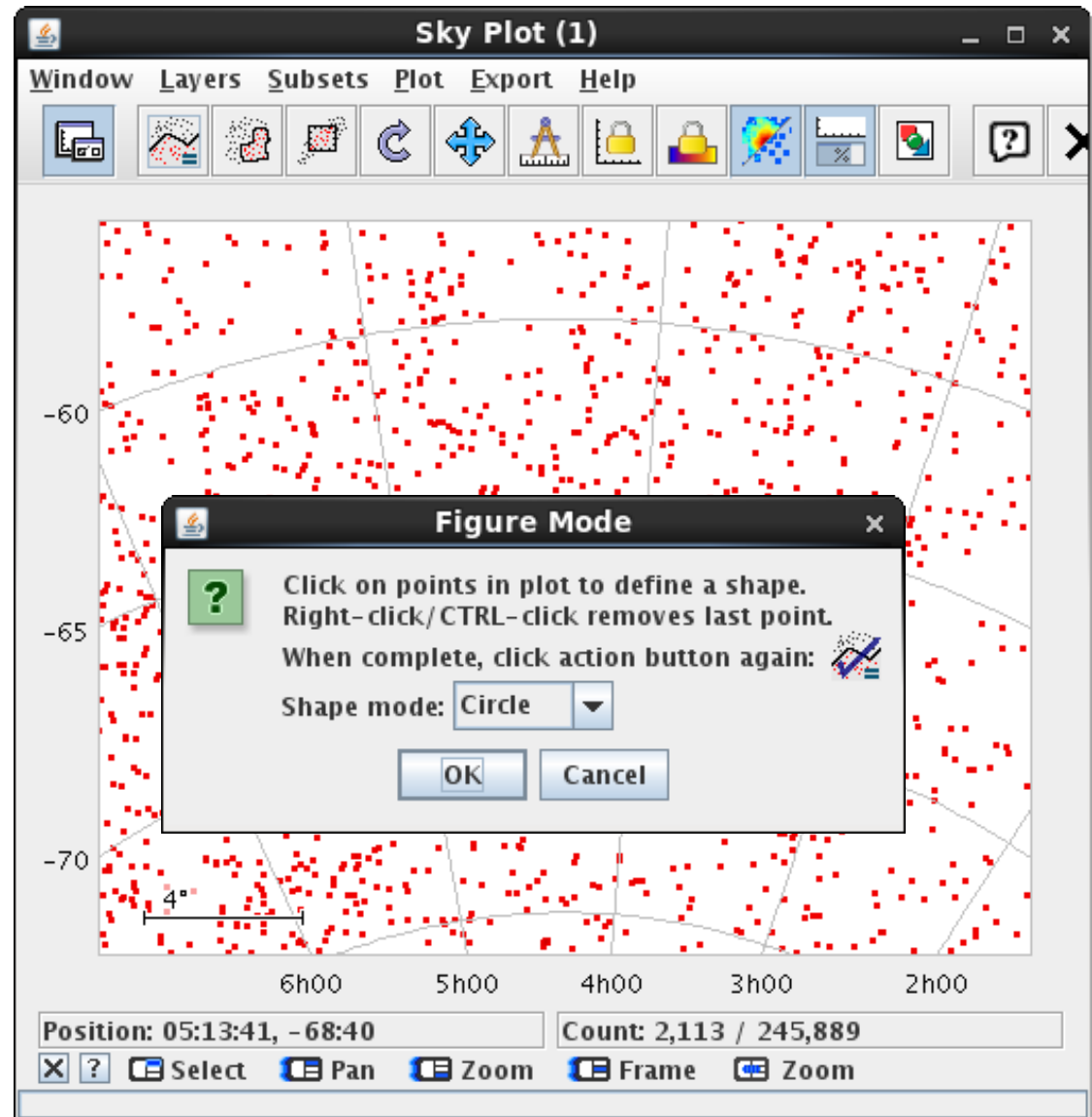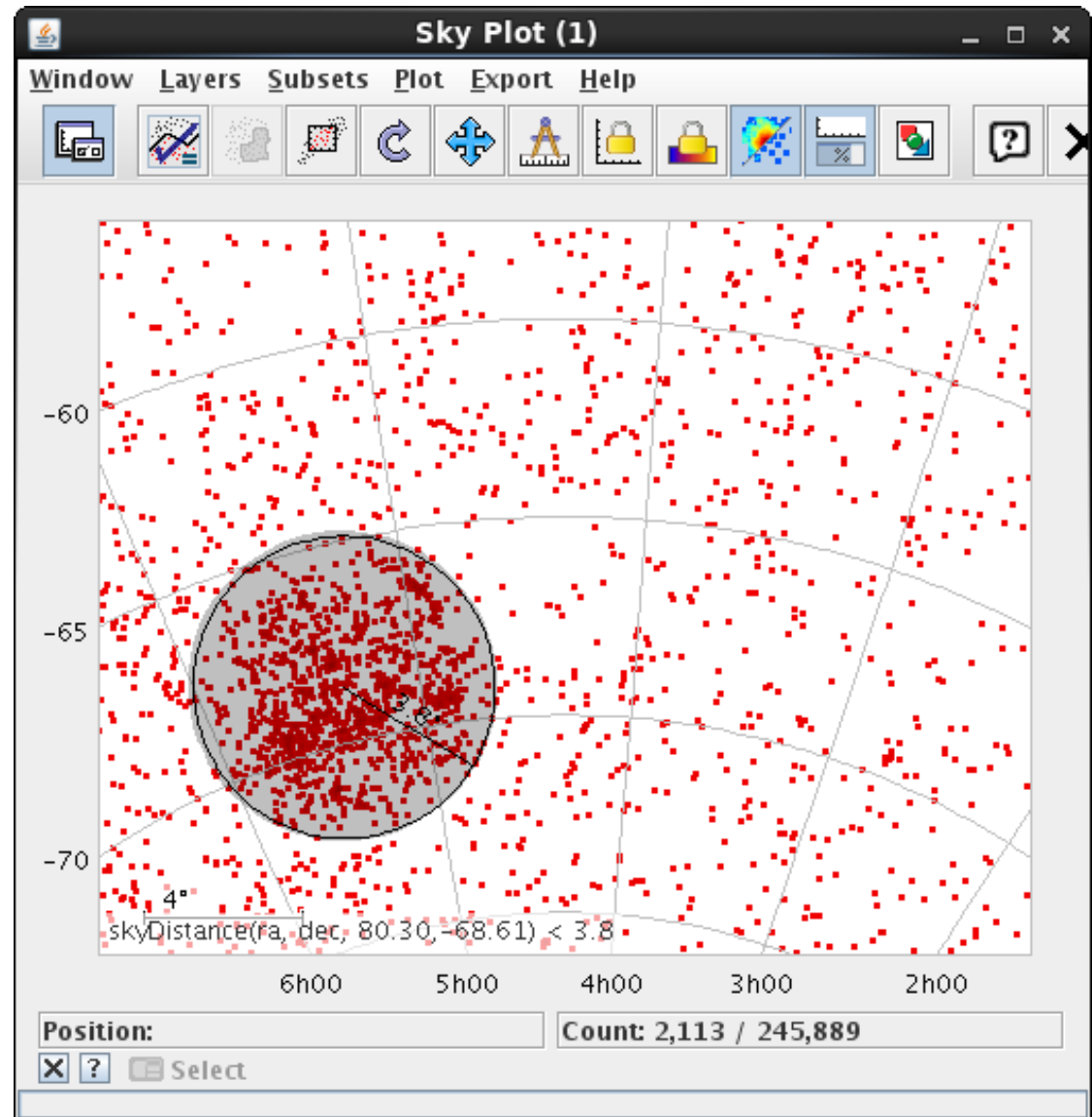More options for selecting subsets graphically

- Plane Plot: Polygon, Ellipse, Above, Below, Left, Right
- Sky Plot: Circle, Polygon

When drawing complete:

- Defines subsets
- Presents TOPCAT expression
- Presents ADQL expression
  - ▷ Sky: Circle, Polygon
  - ▷ Plane: Ellipse, Line
  - ▷ Easily pasted into TAP

Future plans:
better region support
(not just subset selections)

Region Selection

More options for selecting subsets graphically

- Plane Plot: Polygon, Ellipse, Above, Below, Left, Right
- Sky Plot: Circle, Polygon

When drawing complete:

- Defines subsets
- Presents TOPCAT expression
- Presents ADQL expression
  - ▷ Sky: Circle, Polygon
  - ▷ Plane: Ellipse, Line
  - ▷ Easily pasted into TAP

Future plans:
better region support
(not just subset selections)

Region Selection

More options for selecting subsets graphically [icon]

- Plane Plot: Polygon, Ellipse, Above, Below, Left, Right
- Sky Plot: Circle, Polygon

When drawing complete:

- Defines subsets
- Presents TOPCAT expression
- Presents ADQL expression
  - ▷ Sky: Circle, Polygon
  - ▷ Plane: Ellipse, Line
  - ▷ Easily pasted into TAP

Future plans:
better region support
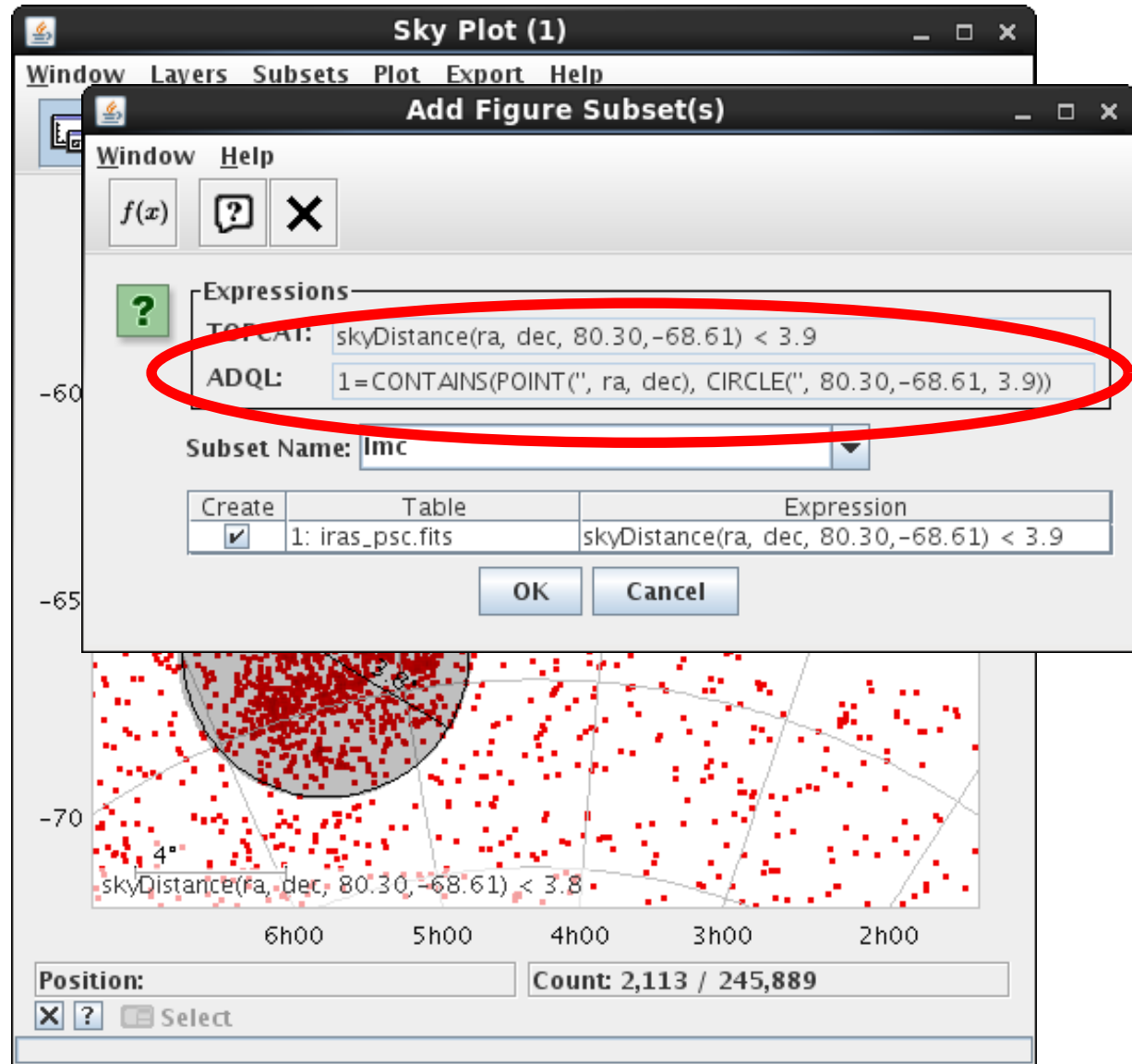(not just subset selections)

Region Selection

More options for selecting subsets graphically

- Plane Plot: Polygon, Ellipse, Above, Below, Left, Right
- Sky Plot: Circle, Polygon

When drawing complete:

- Defines subsets
- Presents TOPCAT expression
- Presents ADQL expression
  - ▷ Sky: Circle, Polygon
  - ▷ Plane: Ellipse, Line
  - ▷ Easily pasted into TAP

Future plans:
better region support
(not just subset selections)

Region Selection

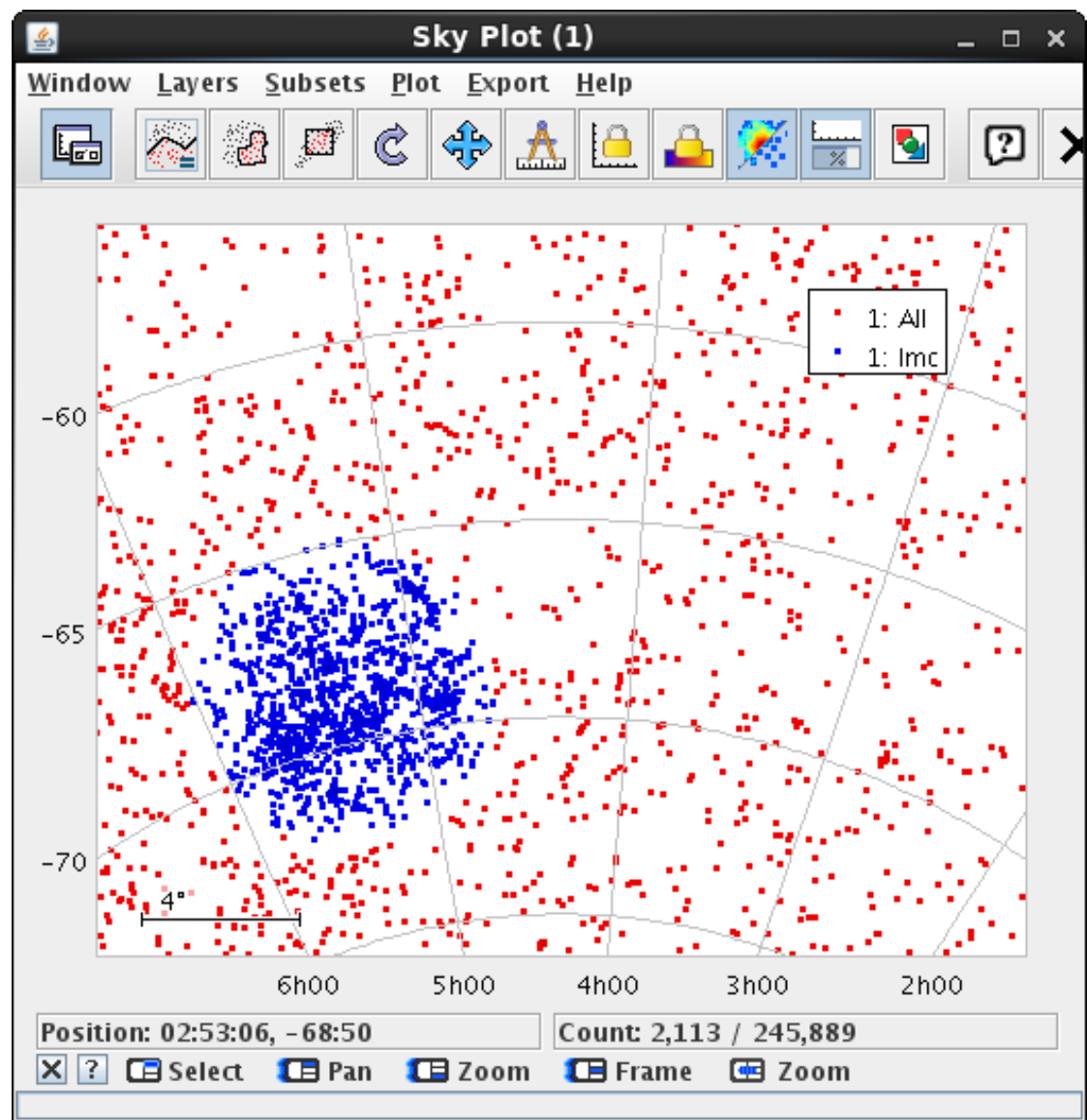More options for selecting subsets graphically

- Plane Plot: Polygon, Ellipse, Above, Below, Left, Right
- Sky Plot: Circle, Polygon

When drawing complete:

- Defines subsets
- Presents TOPCAT expression
- Presents ADQL expression
  - ▷ Sky: Circle, Polygon
 - ▷ Plane: Ellipse, Line
  - ▷ Easily pasted into TAP

Future plans:
better region support
(not just subset selections)

Quadrilateral Plots

New Quad Position layer control

- Supply 4 coordinates to define quadrilateral (or 3 for triangle)
- Suitable for e.g. field of view of planetary observations
- Works for all plot types (sky, plane, 3d, ...)
- Improved use of UCDs for default vertex coordinate values
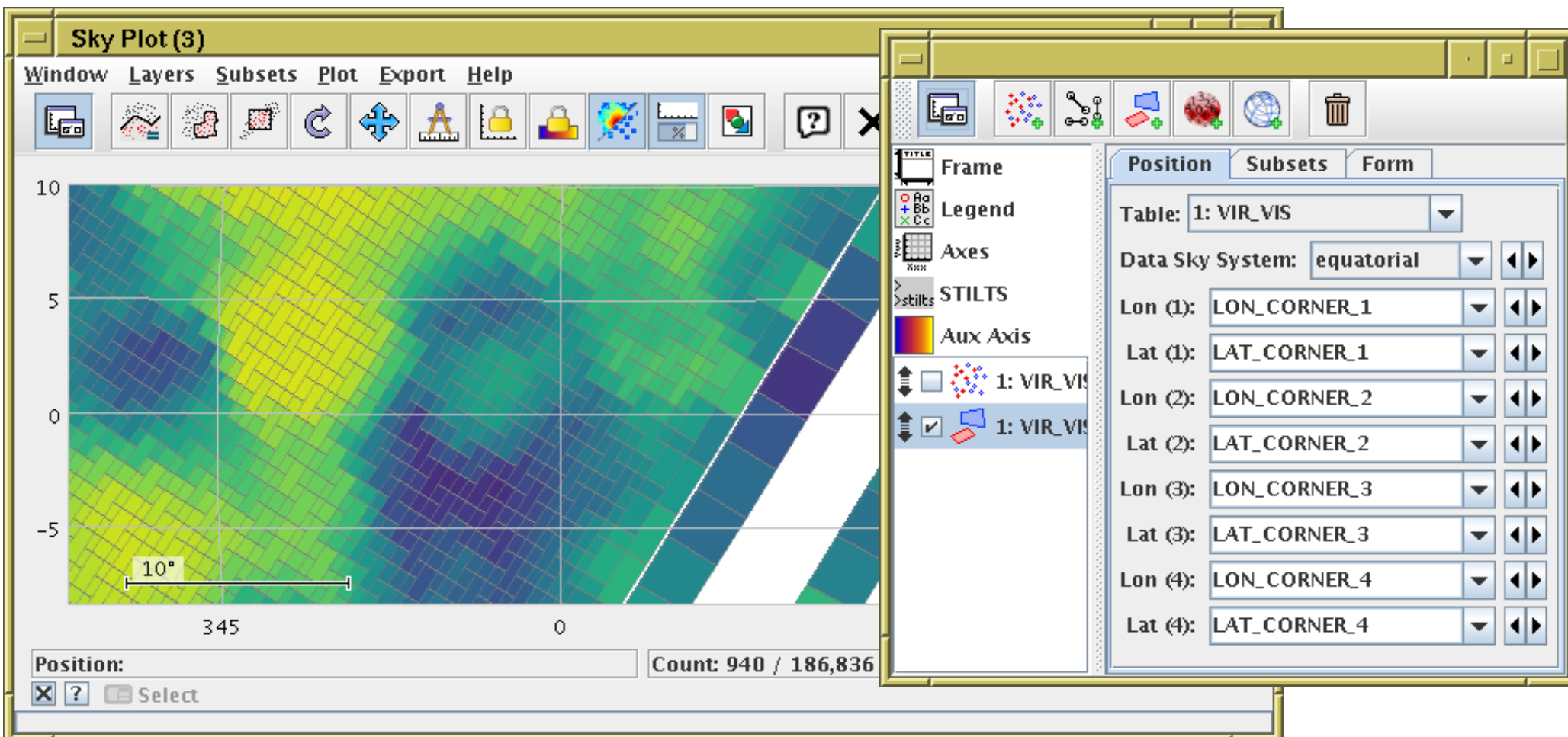
Polygon Plots

New Polygon plot form

- Plots array-valued cells (e.g. `[lon1,lat1, lon2,lat2, lon3,lat3, ...]`)
- Function `parseDoubles` can be used to hack these out of STC-S (e.g. `s_region`)
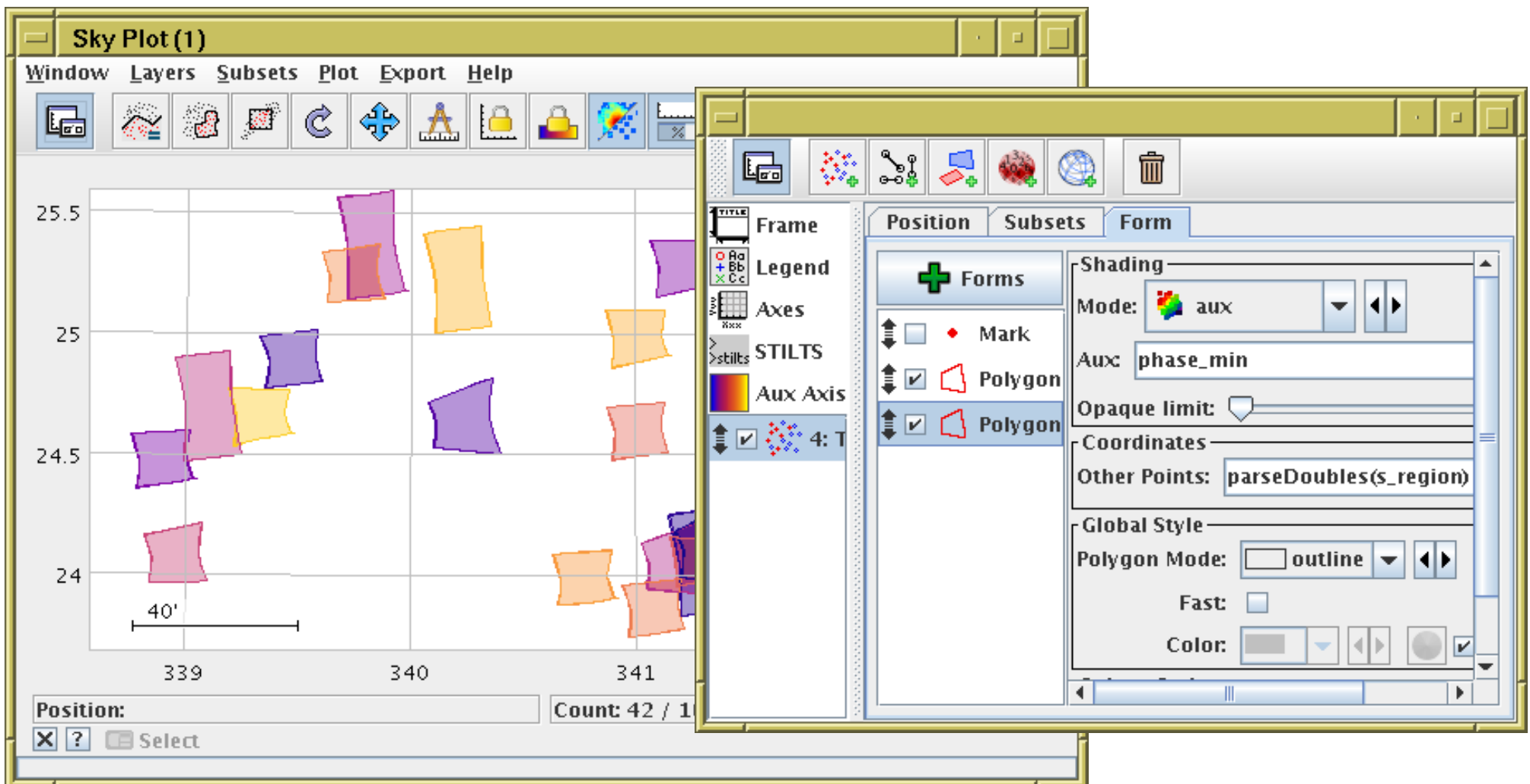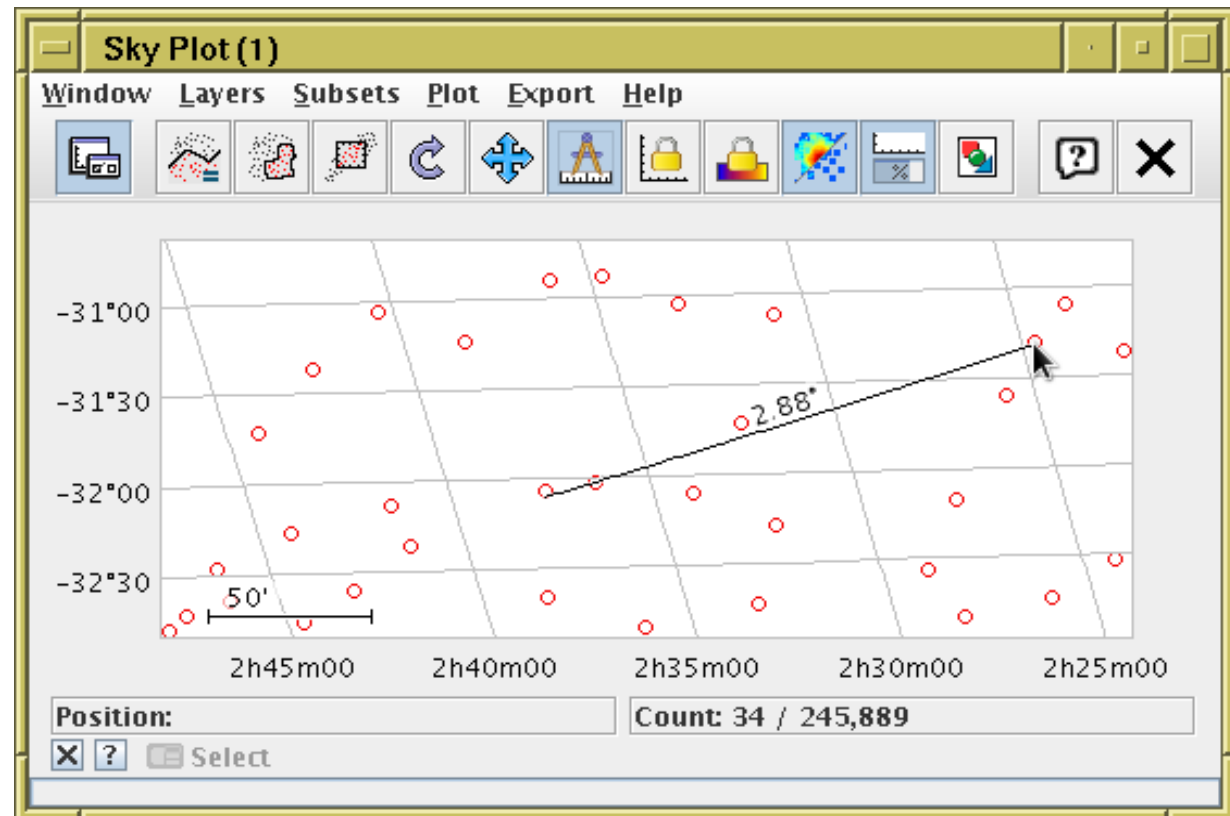
Sky Measurement

Sky plot now has **Scale Bar** labelled in degrees/arcmin/arcsec

- Present by default; can be turned off

New **Measure Distance** interactive tool

- Displays length of interactively dragged line
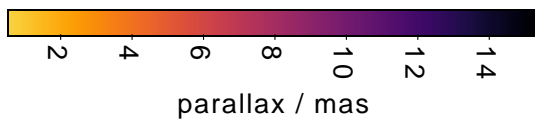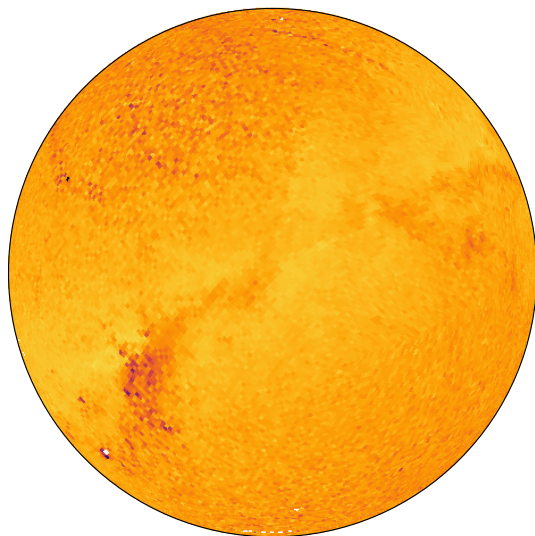- Similar functionality in Plane Plot as well

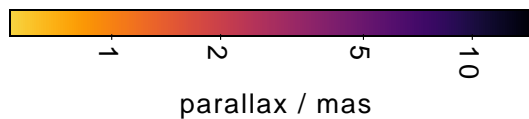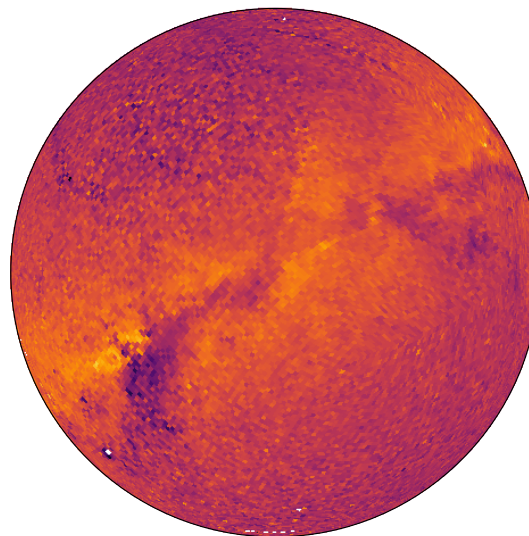*Both ideas stolen from Aladin*
— Thanks!

Colour Map Scaling

New adaptive colour map scaling option

- New Scaling option "histogram"/"histolog"
- Adapts to value distribution, not just linear/log/etc scaling over min–max range
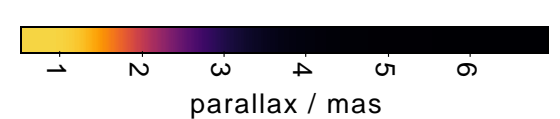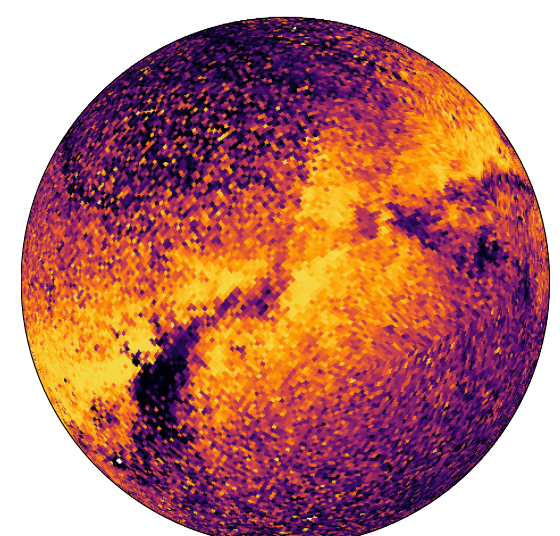- Easier to see structure for unevenly distributed data

scaling=linear   scaling=log   scaling=histogram

HEALPix

Limited support for semi-standard FITS-HEALPix serialization format

- FITS-HEALPix format de facto standard for storing full/partial HEALPix maps in FITS
  - ▷ Already used in Aladin and official HEALPix libraries
- FITS-HEALPix metadata now mapped to STIL table model
- I/O handlers read/write FITS with standard HEALPix metadata
  - ▷ Round-tripping works
  - ▷ Can export 'standard' HEALPix maps from TOPCAT SkyDensity plot
- Support is not perfect
  - ▷ Best efforts for standard FITS output; new `healpix-fits` output format tries harder
  - ▷ Some things unsupported: `BAD_DATA` header, 1024-element array variant

Other HEALPix Plot improvements

- Now plots up to level 20 (was 13)
- Can now select pixels graphically, like points in marker plots

Future:

- Considering move to F-X Pineau's HEALPix library (from PixTools)

HEALPix

Credit: *Stéphane Erard*

Future Plans

Amongst other things...

- Authentication
  - ▷ In progress (see TAP 1.1 Auth experiments in DAL/GWS/Apps/Reg joint session)

- Regions
  - ▷ Some region functionality now introduced
    - ○ Shape drawing produces algebraic/ADQL expressions
    - ○ Quadrilateral and Polygon plotting modes
  - ▷ Hope to have better region manipulation in future releases

- Planetary Science
  - ▷ EuroPlanet 2024/VESPA involvement
  - ▷ Input already from Batiste Rousseau, Stéphane Erard (polygon plotting)
  - ▷ Investigate planetary applications/requirements for TOPCAT