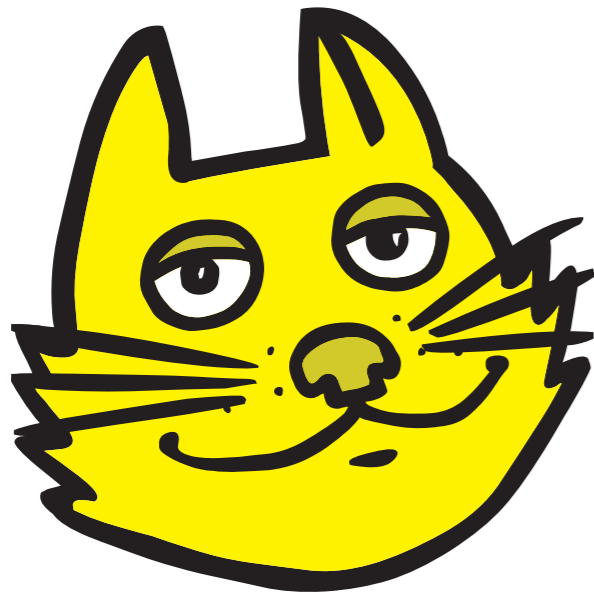


TOPCAT/STILTS Updates



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`$Id: tcupdates.tex,v 1.11 2023/05/09 20:51:54 mbt Exp $`

Outline

TOPCAT v4.8-8, STILTS v3.4-8, released April 2023

- ADQL 2.1
- DataLink 1.1
- Plot Axes
- Other ...

ADQL

Powered by **VOLLT** — thanks Grégory Mantelet

- Using beta version with ADQL 2.1 support (commit [8b88a44](#) on branch [adq12.1](#))

TOPCAT reads `/capabilities` document (TAPRegExt)

- Detects support for:
 - ▷ ADQL 2.1 (else 2.0 default)
 - ▷ optional ADQL features (geometry, CTEs, Sets, unit conversion, ...)
 - ▷ User Defined Functions, including argument syntax
- Reports details in **Service** tab
- Feeds information to parser for syntax checking in ADQL entry panel
- Adjusts **Examples** menu ADQL
- Updates **Hints** tab content

If service is ADQL 2.1, you can select instead ADQL 2.0 in Capabilities Panel

- Not generally useful ...
- ... except for ADQL geeks, syntax declaration checking etc

ADQL

The screenshot displays the 'Table Access Protocol (TAP) Query' application window. The interface is organized into several sections:

- Metadata:** A search area with a 'Find:' field and checkboxes for 'Name' and 'Descrip'. A tree view on the left lists various services under 'GAVO DC TAP (225)', including folders like 'amanda (1)', 'annised (1)', 'antares (1)', 'antares10 (1)', 'apass (1)', 'apo (1)', 'applause (1)', 'arigfh (6)', 'arihip (1)', 'auger (1)', 'bgds (3)', 'boydende (1)', and 'brownwarfs (1)'. The right pane shows details for the selected 'schema' service, including 'Data Models' (ivo://org.gavo.dc/std/glots#tables-1.0, ivo://ivoa.net/std/obscure#core-1.1, ivo://ivoa.net/std/RegTAP#1.1), 'Geometry Functions' (BOX, POINT, CIRCLE, POLYGON, REGION, CENTROID, COORD1, COORD2, DISTANCE, CONTAINS, INTERSECTS, AREA), 'ADQL 2.1 Optional Features' (LOWER, ILIKE, OFFSET, CAST, IN_UNIT, WITH, UNION, EXCEPT, INTERSECT), and 'User-Defined Functions' (gavo_apply_pm).
- Service Capabilities:** A section with dropdown menus for 'Query Language: ADQL-2.1', 'Max Rows: 20000 (default)', and 'Uploads: 100Mb'.
- ADQL Text:** A section with a 'Mode: Synchronous' dropdown and a toolbar containing icons for copy, paste, undo, redo, and other actions. Below the toolbar is a large text area for entering the query.
- Buttons:** 'Examples' and 'Info' buttons are located at the bottom left, and a 'Run Query' button is centered at the bottom.

ADQL

The screenshot shows the 'Table Access Protocol (TAP) Query' application window. The interface includes a menu bar (Window, TAP, Registry, Edit, Interop, Help) and a toolbar with icons for pinning, refreshing, help, and closing. Below the toolbar are tabs for 'Select Service', 'Use Service', 'Resume Job', and 'Running Jobs'. The main area is divided into two sections: 'Metadata' and 'Service Capabilities'.
The 'Metadata' section has a 'Find:' field and checkboxes for 'Name' and 'Descrip'. A tree view on the left lists various services under 'GAVO DC TAP (225)', including folders like 'amanda', 'annisred', 'antares', etc. The right pane shows details for a selected service, with tabs for 'Service', 'Schema', 'Table', 'Columns', 'FKeys', and 'Hints'. The 'Service' tab is active, displaying 'Data Models', 'Geometry Functions', 'ADQL 2.1 Optional Features', and 'User Defined Functions'. A red oval highlights the 'Geometry Functions' section, which lists: BOX, POINT, CIRCLE, POLYGON, REGION, CENTROID, COORD1, COORD2, DISTANCE, CONTAINS, INTERSECTS, AREA.
The 'Service Capabilities' section shows 'Query Language' set to 'ADQL-2.1' (circled in red), 'Max Rows' set to '20000 (default)', and 'Uploads' set to '100Mb'. Below this is the 'ADQL Text' section with a 'Mode' dropdown set to 'Synchronous' and a toolbar with icons for adding, deleting, and executing queries. At the bottom, there are 'Examples' and 'Info' buttons, and a 'Run Query' button.

ADQL

The screenshot shows the 'Table Access Protocol (TAP) Query' application window. The interface includes a menu bar (Window, TAP, Registry, Edit, Interop, Help) and a toolbar with icons for pinning, refreshing, help, and closing. Below the toolbar are tabs for 'Select Service', 'Use Service', 'Resume Job', and 'Running Jobs'. The main area is divided into two panes. The left pane, titled 'Metadata', contains a 'Find:' search box and a tree view of services. The right pane, titled 'Service', displays details for the selected 'GAVO DC TAP' service, including its short name, title, IVO ID, service URL, reference URL, examples URL, size, publisher, and creator. Below these panes is the 'Service Capabilities' section, which includes a 'Query Language' dropdown set to 'ADQL-2.1', 'Max Rows' set to '20000 (default)', and 'Uploads' set to '100Mb'. The 'ADQL Text' section features a 'Mode' dropdown set to 'Synchronous' and a toolbar with various icons. The main text area contains the following ADQL query:

```
SELECT TOP 1000
FROM arihip.main AS a
JOIN gdr2mock.main AS b
ON DISTANCE(a.raj2000, a.dej2000, b.ra, b.dec) < 5./3600.
```

At the bottom, there is an 'Examples' section with a dropdown menu showing 'Basic 6/6: Sky pair match' and an 'Info' icon. A 'Run Query' button is located at the very bottom of the window.

ADQL

The screenshot shows the 'Table Access Protocol (TAP) Query' application window. The interface includes a menu bar (Window, TAP, Registry, Edit, Interop, Help) and a toolbar with icons for pinning, refreshing, help, and closing. Below the toolbar are tabs for 'Select Service', 'Use Service', 'Resume Job', and 'Running Jobs'. The main area is divided into two panes. The left pane, titled 'Metadata', contains a 'Find:' search box and a tree view of services. The right pane, titled 'Service', displays details for the selected service, 'GAVO DC TAP (225)'. The 'Service Capabilities' section shows 'Query Language: ADQL-2.0', 'Max Rows: 20000 (default)', and 'Uploads: 100Mb'. The 'ADQL Text' section shows a query in 'Synchronous' mode. The query text is:

```
SELECT TOP 1000
FROM arihip.main AS a
JOIN gdr2mock.main AS b
ON 1=CONTAINS(POINT('ICRS', a.ra2000, a.dec2000),
CIRCLE('ICRS', b.ra, b.dec, 5./3600.))
```

 The 'Examples' section at the bottom shows 'Basic 6/6: Sky pair match'. A 'Run Query' button is located at the bottom center.

Table Access Protocol (TAP) Query

Window TAP Registry Edit Interop Help

Select Service Use Service Resume Job Running Jobs

Metadata

Find:

Name Descrip Or

GAVO DC TAP (225)

- amanda (1)
- annisred (1)
- antares (1)
- antares10 (1)
- apass (1)
- apo (1)
- applause (1)
- arigfh (6)
- arihip (1)
 - arihip.main
- auger (1)
- bgds (3)
- boydende (1)
- browndwarfs (1)

Service

Short Name: GAVO DC TAP

Title: GAVO Data Center TAP service

IVO ID: ivo://org.gavo.dc/tap

Service URL: http://dc.zah.uni-heidelberg.de/tap

Reference URL: http://dc.zah.uni-heidelberg.de/_system_/tap/run/info

Examples URL: http://dc.zah.uni-heidelberg.de/tap/examples

Size: 112 schemas, 225 tables

Publisher: The GAVO DC team

Creator: GAVO Data Center

Service Capabilities

Query Language: ADQL-2.0 Max Rows: 20000 (default) Uploads: 100Mb

ADQL Text

Mode: Synchronous

```
SELECT TOP 1000
FROM arihip.main AS a
JOIN gdr2mock.main AS b
ON 1=CONTAINS(POINT('ICRS', a.ra2000, a.dec2000),
CIRCLE('ICRS', b.ra, b.dec, 5./3600.))
```

Examples Basic 6/6: Sky pair match Info

Run Query

ADQL

The screenshot shows the 'Table Access Protocol (TAP) Query' application window. The interface includes a menu bar (Window, TAP, Registry, Edit, Interop, Help) and a toolbar with icons for pinning, refreshing, help, and closing. Below the toolbar are tabs for 'Select Service', 'Use Service', 'Resume Job', and 'Running Jobs'. The main area is divided into two panes. The left pane, titled 'Metadata', contains a search field and a tree view of services. The right pane shows details for the selected service, 'GAVO DC TAP (225)'. The 'Service Capabilities' section includes a dropdown for 'Query Language' set to 'ADQL-2.0', 'Max Rows' set to '20000 (default)', and 'Uploads' set to '100Mb'. The 'ADQL Text' section shows a query in 'Synchronous' mode. The query text is:

```
WITH sample AS (  
  SELECT * FROM gdr2mock.main  
  WHERE distance(ra, dec, 66.73, 75.87)<1)  
SELECT  
  ROUND(teff_val*0.01)/0.01 AS bin, avg(1/parallax) AS meandistance  
FROM sample  
GROUP BY bin
```

 At the bottom, there are 'Examples' and 'Info' buttons, and a 'Run Query' button.

Table Access Protocol (TAP) Query

Window TAP Registry Edit Interop Help

Select Service Use Service Resume Job Running Jobs

Metadata

Find:

Name Descrip Or

- GAVO DC TAP (225)
 - amanda (1)
 - annisred (1)
 - antares (1)
 - antares10 (1)
 - apass (1)
 - apo (1)
 - applause (1)
 - arigfh (6)
 - arihip (1)
 - arihip.main
 - auger (1)
 - bgds (3)
 - boydende (1)
 - browndwarfs (1)

Service

Short Name: GAVO DC TAP

Title: GAVO Data Center TAP service

IVO ID: ivo://org.gavo.dc/tap

Service URL: http://dc.zah.uni-heidelberg.de/tap

Reference URL: http://dc.zah.uni-heidelberg.de/_system_/tap/run/info

Examples URL: http://dc.zah.uni-heidelberg.de/tap/examples

Size: 112 schemas, 225 tables

Publisher: The GAVO DC team

Creator: GAVO Data Center

Service Capabilities

Query Language: ADQL-2.0 Max Rows: 20000 (default) Uploads: 100Mb

ADQL Text

Mode: Synchronous

```
WITH sample AS (  
  SELECT * FROM gdr2mock.main  
  WHERE distance(ra, dec, 66.73, 75.87)<1)  
SELECT  
  ROUND(teff_val*0.01)/0.01 AS bin, avg(1/parallax) AS meandistance  
FROM sample  
GROUP BY bin
```

Examples Service-Provided 16/17: Using CTEs to test queries on large tables Info

Run Query

ADQL

The screenshot shows the 'Table Access Protocol (TAP) Query' application window. The interface includes a menu bar (Window, TAP, Registry, Edit, Interop, Help) and a toolbar with icons for pinning, refreshing, help, and closing. Below the menu is a tabbed interface with 'Select Service', 'Use Service', 'Resume Job', and 'Running Jobs' tabs. The 'Select Service' tab is active, displaying a tree view of metadata on the left and a detailed view on the right. The tree view shows a hierarchy of services, with 'arihip.main' selected. The detailed view shows the following metadata for 'GAVO DC TAP':

- Short Name:** GAVO DC TAP
- Title:** GAVO Data Center TAP service
- IVO ID:** ivo://org.gavo.dc/tap
- Service URL:** http://dc.zah.uni-heidelberg.de/tap
- Reference URL:** http://dc.zah.uni-heidelberg.de/_system_/tap/run/info
- Examples URL:** http://dc.zah.uni-heidelberg.de/tap/examples
- Size:** 112 schemas, 225 tables
- Publisher:** The GAVO DC team
- Creator:** GAVO Data Center

Below the metadata is the 'Service Capabilities' section, which includes a dropdown for 'Query Language' set to 'ADQL-2.1', 'Max Rows' set to '20000 (default)', and 'Uploads' set to '100Mb'. The 'ADQL Text' section has a 'Mode' dropdown set to 'Synchronous' and a toolbar with various icons. The ADQL query text is as follows:

```
WITH sample AS (  
  SELECT * FROM gdr2mock.main  
  WHERE distance(ra, dec, 66.73, 75.87)<1)  
SELECT  
  ROUND(teff_val*0.01)/0.01 AS bin, avg(1/parallax) AS meandistance  
FROM sample  
GROUP BY bin
```

At the bottom of the window, there is a 'Run Query' button and a status bar showing 'Service-Provided 16/17: Using CTEs to test queries on large tables'.

ADQL

Table Access Protocol (TAP) Query

Window TAP Registry Edit Interop Help

Select Service Use Service Resume Job Running Jobs

Metadata

Find:

Name Descrip Or

- GAVO DC TAP (225)
 - amanda (1)
 - annisred (1)
 - antares (1)
 - antares10 (1)
 - apass (1)
 - apo (1)
 - applause (1)
 - arigfh (6)
 - arihip (1)
 - arihip.main
 - auger (1)
 - bgds (3)
 - boydende (1)
 - browndwarfs (1)

Service Capabilities

Query Language: **ADQL-2.1** Max Rows: 20000 (default) Uploads: 100Mb

ADQL Text

Mode: Synchronous

1

Examples

Run Query

Very basic ADQL 2.1 cheat sheet

Examples

Use the **Examples** button at the bottom of this window!

This service has data-specific examples: you can see them in the **Service Provided** Examples sub-menu, or **with explanation** in your browser.

SELECT statement:

```
[WITH <name> AS (SELECT ...)]
SELECT [TOP n] <select-list>
FROM <table-and-join-expression>
[WHERE <conditions>]
[GROUP BY <column-list>]
[HAVING <conditions>]
[ORDER BY <column-list>]
SELECT t.<col1> AS a, t.<col2> AS b FROM <table> AS t
```

ADQL

Table Access Protocol (TAP) Query

Window TAP Registry Edit Interop Help

Select Service Use Service Resume Job Running Jobs

Metadata

Find:

Name Descrip Or

- GAVO DC TAP (225)
 - amanda (1)
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 - browndwarfs (1)

Service Schema Table Columns FKeys Hints

Very basic ADQL 2.0 cheat sheet

[Examples](#)

Use the [Examples](#) button at the bottom of this window!

This service has data-specific examples: you can see them in the [Service Provided](#) Examples sub-menu, or [with explanation](#) in your browser.

[SELECT statement:](#)

```
SELECT [TOP n] <select-list>
FROM <table-and-join-expression>
[WHERE <conditions>]
[GROUP BY <column-list>]
[HAVING <conditions>]
[ORDER BY <column-list>]

SELECT t.<col1> AS a, t.<col2> AS b FROM <table> AS t
SELECT * FROM <table1> JOIN <table2> ON <expression>
```

Service Capabilities

Query Language: **ADQL-2.0** Max Rows: 20000 (default) Uploads: 100Mb

ADQL Text

Mode: Synchronous

1

Examples Info

Run Query

ADQL

Users

- Probably won't notice this change in behaviour
- Hopefully it will just help them to do the right thing
(and not get confused because syntax is different for different services)

Service Providers

- Implement ADQL 2.1 if you can
- Make sure your VOSI [capabilities](#) document declares optional features etc (TAPRegExt)
- Remember: `DISTANCE(ra1,dec1,ra2,dec2)<dist` is preferred crossmatch/cone condition

TOPCAT and DataLink 1.1

- New metadata used to improve guesses about DL result handling
 - ▷ `content_qualifier` helps to decide on default action for link target
 - ▷ `local_semantics` helps to predict user link choice based on last choice

VOTable I/O

- Service Descriptor PARAMs `contentType` and `exampleURL` now preserved on round trip I/O

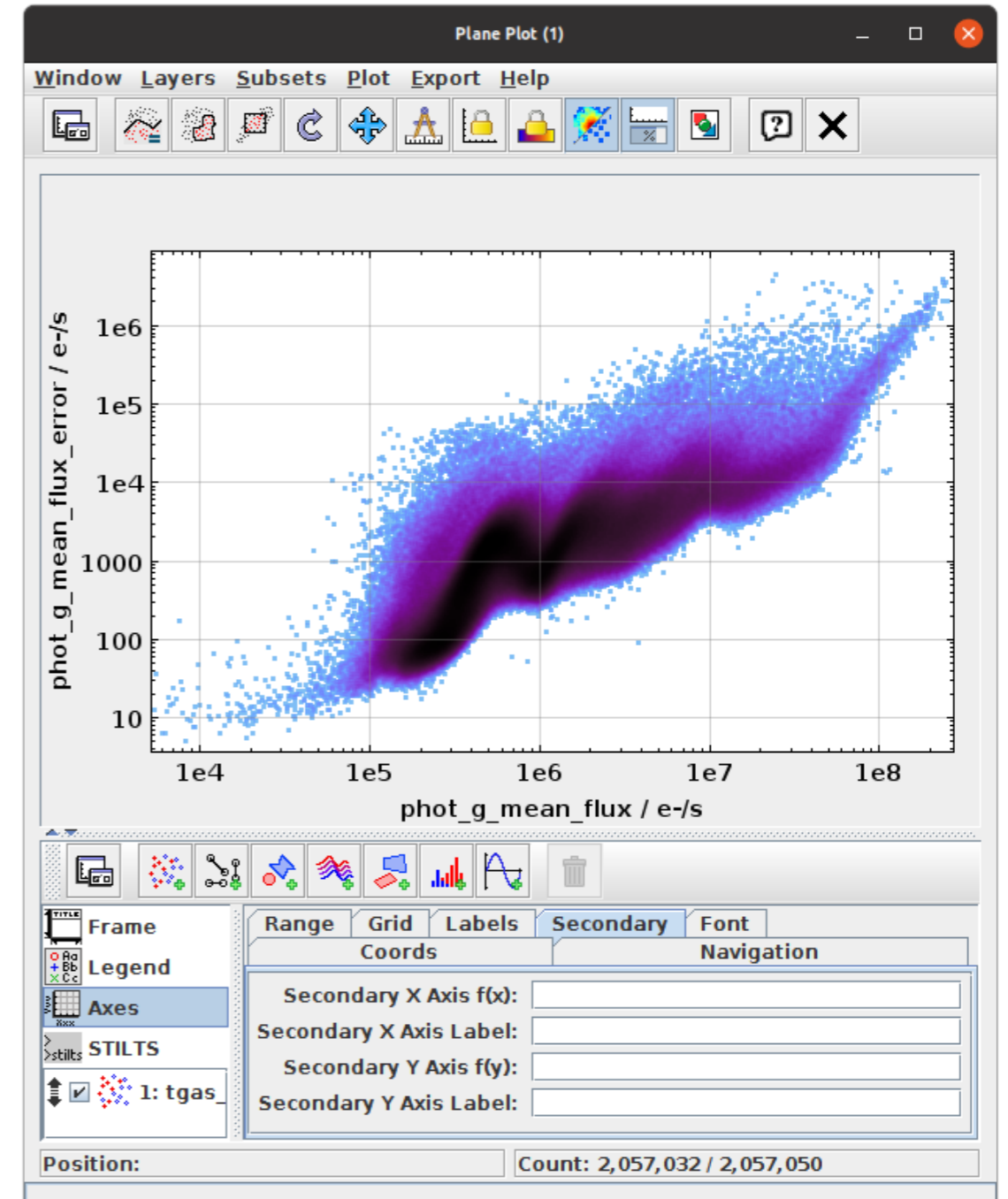
STILTS `datalinklint`

- Validates DataLink links-response tables
- Can now check DataLink 1.0 or (PR-20230413) 1.1
- 1.1-specific checks:
 - ▷ Required standardID INFO
 - ▷ Contiguous rows for same ID
 - ▷ Content of columns `content_qualifier`, `link_auth`, `link_authorized`
 - ▷ Recommended name/DESCRIPTION metadata for (especially multiple) service descriptors
- Version determination:
 - ▷ Has parameter `version = "1.0"` or `"1.1"`, effectively defaults to 1.1
 - ▷ Currently no way to determine from links response table what version it's supposed to be — see DL [Issue #96](#)
- Checks on semantics terms now check online vocabularies if necessary (e.g. <https://www.ivoa.net/rdf/datalink/core/>)
- **Does/should anybody validate links response tables routinely?**

Plot Axes

Several (overdue) improvements in plot axis drawing

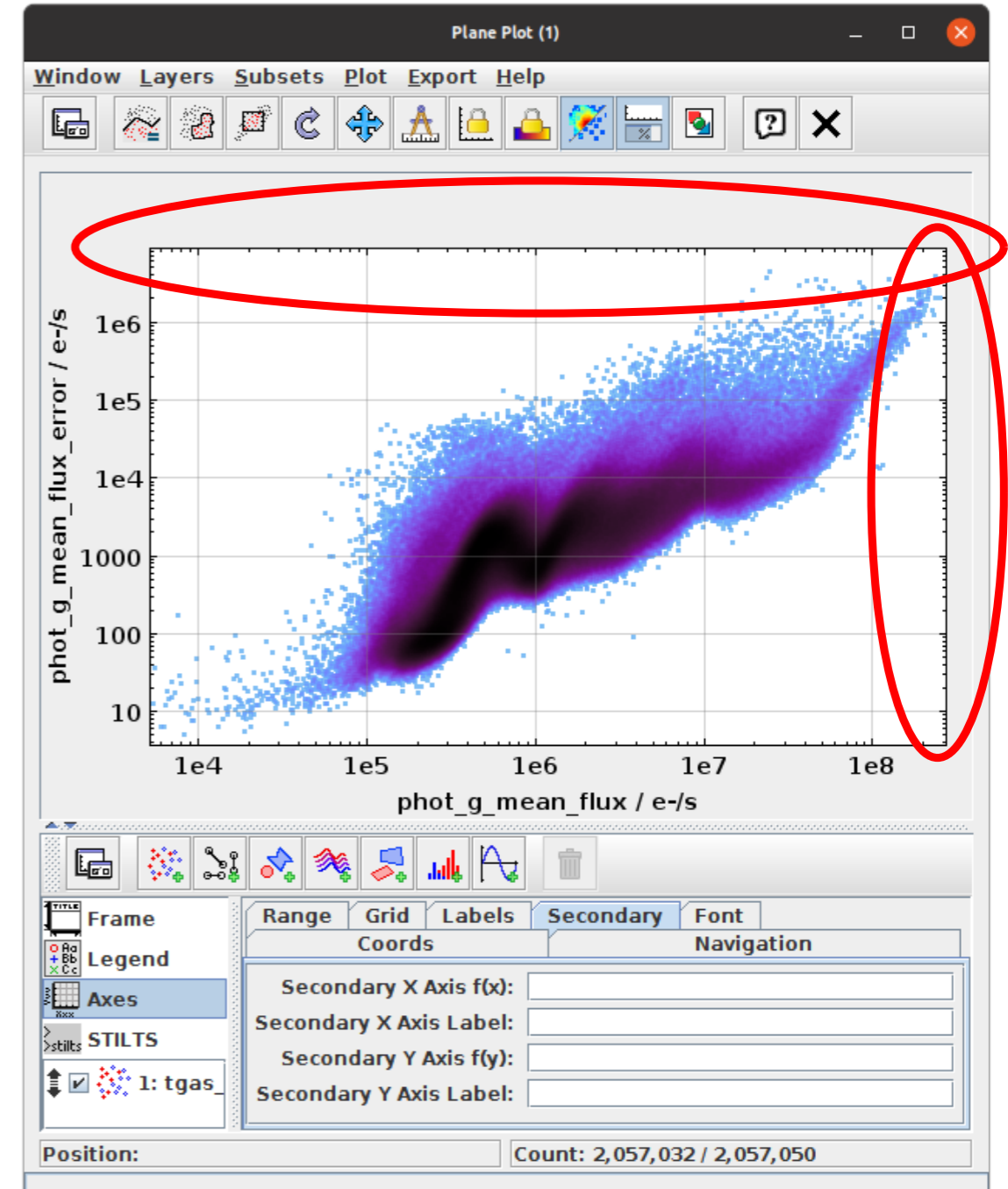
- Tick marks on all four axes by default
- “Secondary axes” possible — different scales on top/bottom or left/right axes (defined algebraically)
- Variable transparency on grid lines
- Minor tick marks not so crowded
→ plots a bit less ugly
- Applies to **Plane** and **Time** plots



Plot Axes

Several (overdue) improvements in plot axis drawing

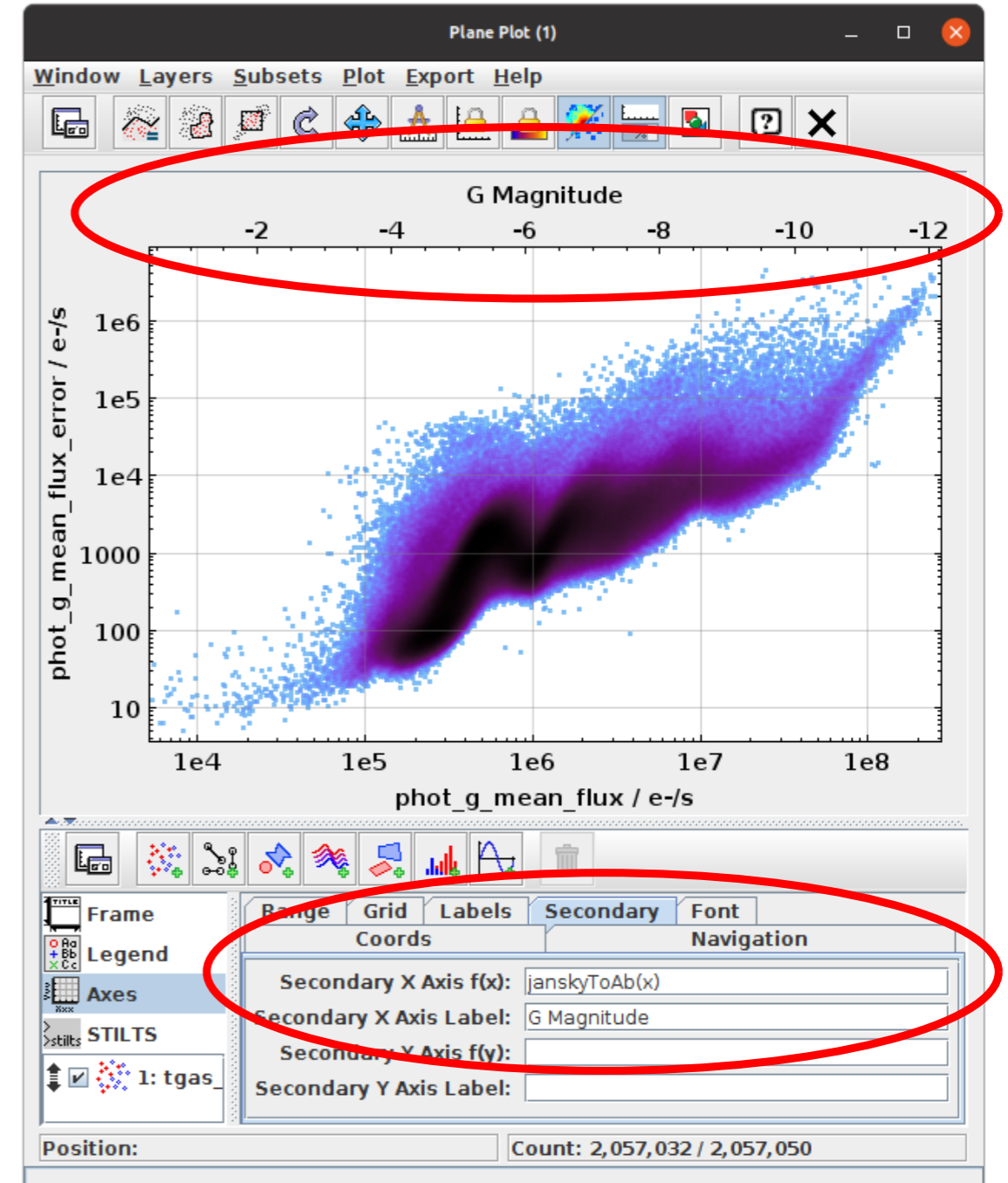
- Tick marks on all four axes by default
- “Secondary axes” possible — different scales on top/bottom or left/right axes (defined algebraically)
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Plot Axes

Several (overdue) improvements in plot axis drawing

- Tick marks on all four axes by default
- “Secondary axes” possible — different scales on top/bottom or left/right axes (defined algebraically)
- Variable transparency on grid lines
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→ plots a bit less ugly
- Applies to **Plane** and **Time** plots



Miscellaneous

Various other minor enhancements, bugfixes, workarounds

- Can draw ellipse shapes for graphical subset selection on Sky plot
- New function `inSkyEllipse(ra0, dec0, raCenter, decCenter, rA, rB, posAng)`
- Hierarchical Service-Provided Example menus in TAP window
- UCD validation updated to UCDFList v1.5 (thanks to Grégory Mantelet Ucidy library)
- Recognised “smoc” as well as “moc” in xtypes
- ECSV reader performance improved, especially for Gaia DR3 bulk download files
- JDBC reader now reads array values from RDBMS
- Bug fixes, performance enhancements, ...

See the web pages for more detail

<http://www.starlink.ac.uk/topcat/>

<http://www.starlink.ac.uk/stilts/>