

TOPCAT Latest

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Outline

- Summarise new features in previous version 4.4 (03/2017)
- New features in recent version 4.5 (09/2017)
 - TOPCAT/STILTS integration (visualisation)
 - New plot options: Extra sky coord grid, Correlated error ellipses
 - Session save improvements
 - Wide FITS tables (>999 columns)
 - Click-to-sort JTables
 - VOTable changes
 - VO Miscellanea
- Future plans

Previous Release

TOPCAT v4.4, release 8 March 2017

-  Free colour chooser
-  **Grid** plotter
-  **Quantile** plotter
-  **Gaussian** plotter
- Form GUI changed
- Improved documentation - more screenshots in manual/help
- More histogram normalisation modes
- ... and some other things

Latest Release

TOPCAT v4.5, release 29 September 2017

-  TOPCAT/STILTS integration for plotting
-  SkyGrid layer for overplotting coord systems
-  Gaia-style correlation error ellipses
- **Save Session** now saves calculated column/subset expressions
- Click-to-sort on more JTables (including Columns Window)
- Wide FITS tables (>999 columns)
- VOTable COOSYS handling
- VOTable output is now v1.3 by default (with BINARY2 option)

TOPCAT/STILTS Integration

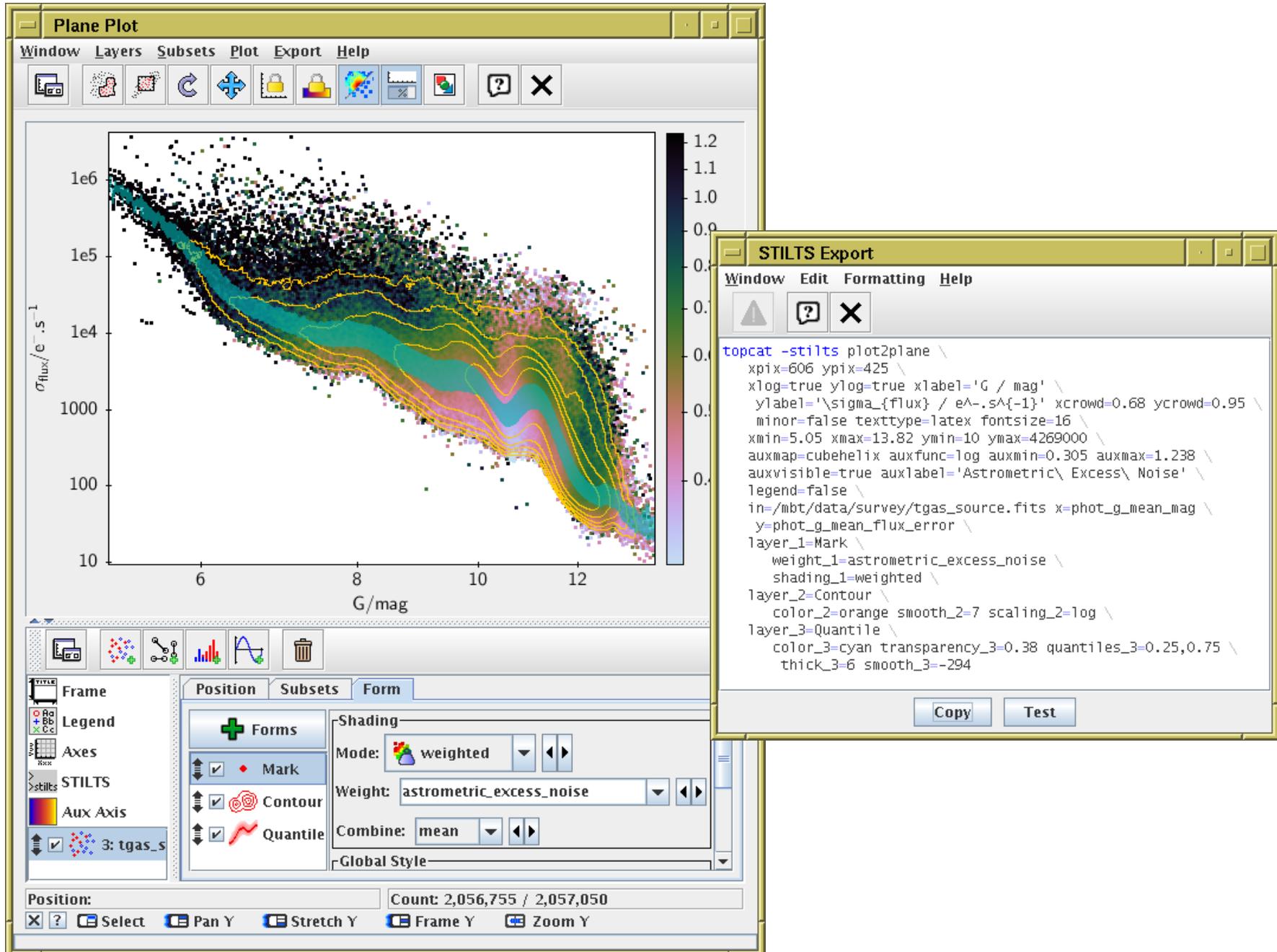
STILTS usage

- Nearly all TOPCAT capabilities are available from STILTS as well
- STILTS (CLI) should be a useful complement to TOPCAT (GUI)
 - ▷ scripting, reproducibility, plots for publication, ...
- But STILTS doesn't seem much used (citations, anecdotal)
- Command line tool harder to learn than point'n'click

Make it easier for TOPCAT users to transition

- User sets up behaviour using TOPCAT GUI, equivalent STILTS script is displayed
- Current release: available for all visualisation windows ( STILTS tab/window)
 - ▷ Displayed command updated continuously as plot is adjusted
 - ▷ Mostly works well
 - ▷ Functionality is ~95% complete
 - ▷ May have bugs (implementation is quite complex)
 - ▷ Will more users use STILTS plots?
- Future versions: some other functionality too
 - ▷ Crossmatch?
 - ▷ VO queries?

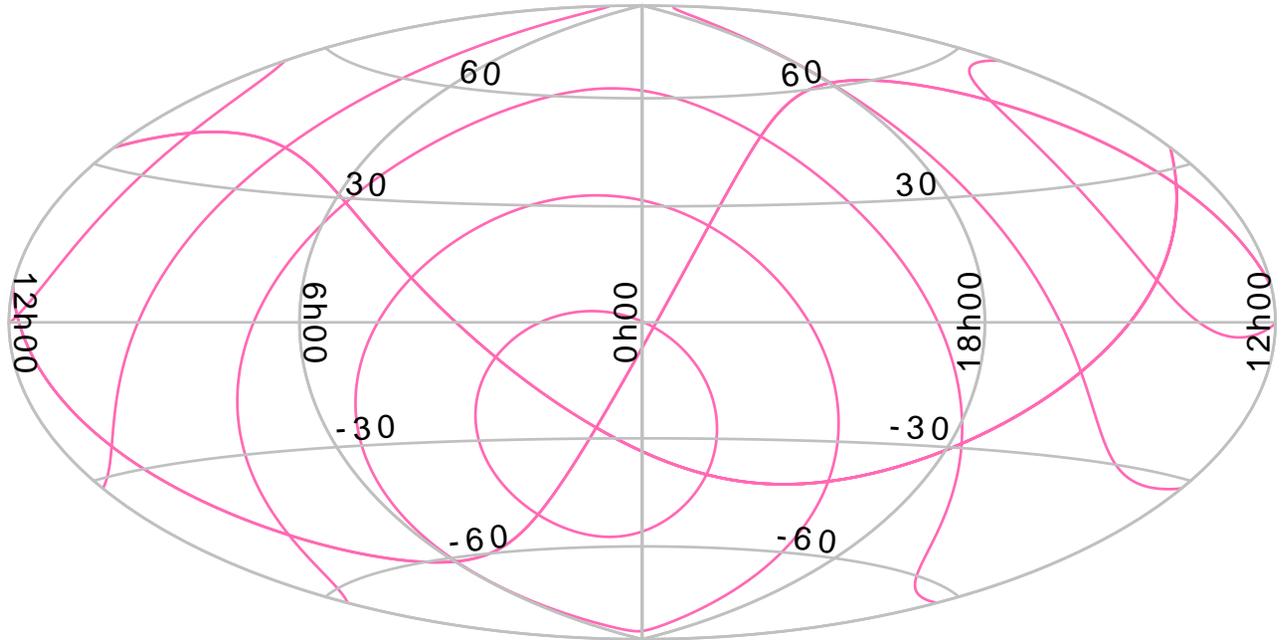
TOPCAT/STILTS Integration



SkyGrid Plot

Overplot additional sky coordinate grid(s) on sky plot

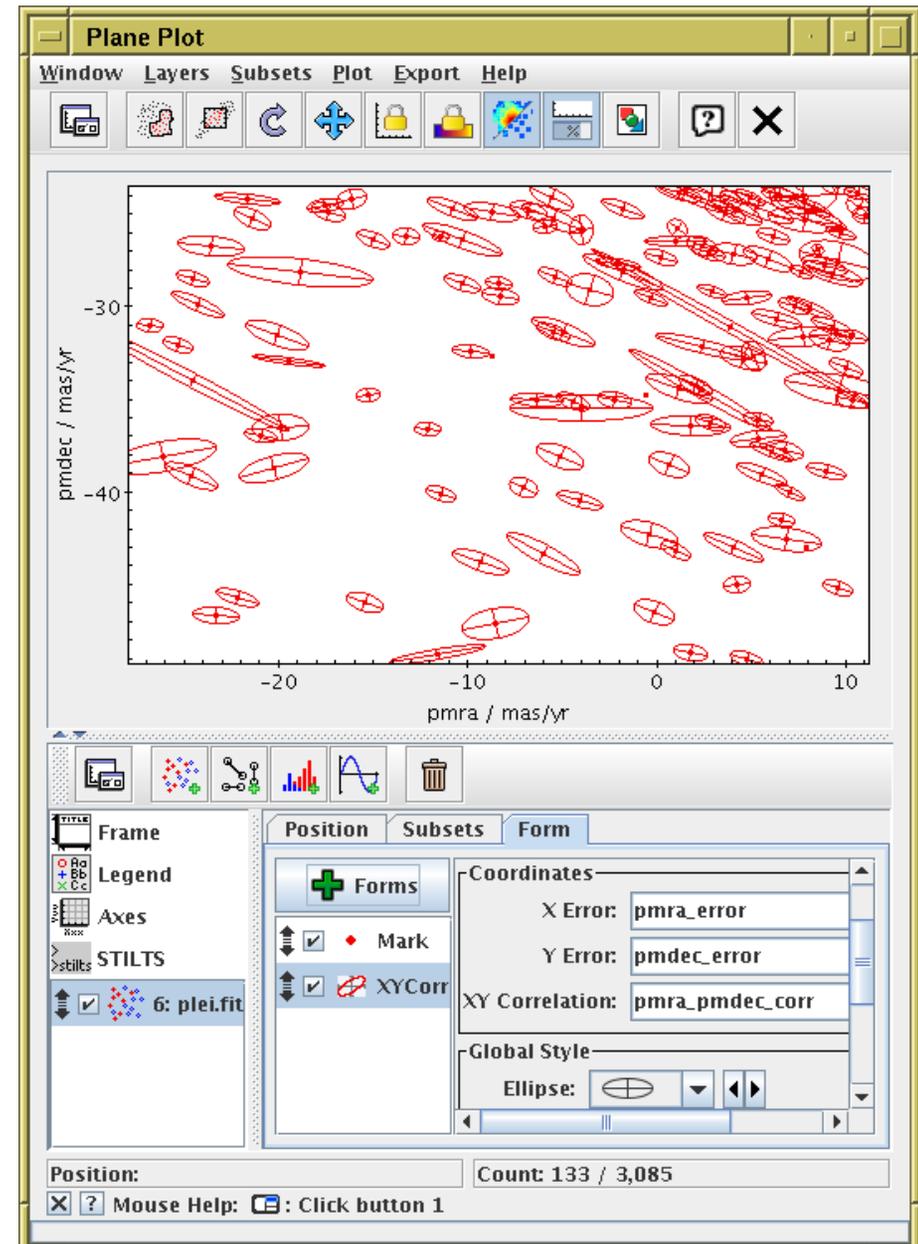
- Only a few options: equatorial, ecliptic, galactic, supergalactic
... probably enough?



Gaia-Style Error Ellipses

New XYCorr option plots error/error/correlation ellipses

- Gaia supplies covariance matrix elements (e.g. `pmra_error`, `pmra_pmdec_corr`) for α , δ , μ_{α^*} , μ_{δ} , ϖ
- Fiddly algebra to turn into position angle
- New Gaia-friendly plot option makes it easy
- SkyCorr option also available
 - ▷ ... but Gaia position errors are generally too tiny to see!



Save Session

TOPCAT has a **Save Session** option

- Saves all current tables in one file
- Includes all defined Row Subsets and created columns
- ... but till now stored them as numbers not algebraic expressions
 - ▷ Columns as numeric cell values
 - ▷ Row Subsets as bitmasks

Now saves algebraic columns and subsets **by expression**

- State is better preserved over session save/load cycle
- You can see what expressions you used to define columns/selections
- You can edit expressions
- Session files are smaller

Wide FITS

FITS limitation:

- The most efficient storage format for TOPCAT is FITS binary table
 - Predictable file layout + Memory mapping
 - ⇒ Instant load + Efficient sequential/random access
- BINTABLE has a maximum column count of 999
- Sometimes tables have >999 columns
 - ▷ not often, but joining 2 or 3 (or more) wide tables can do it
- Had to use some other format (VOTable? CSV?) for these wide tables
 - not very efficient (especially since such tables tend to be large)

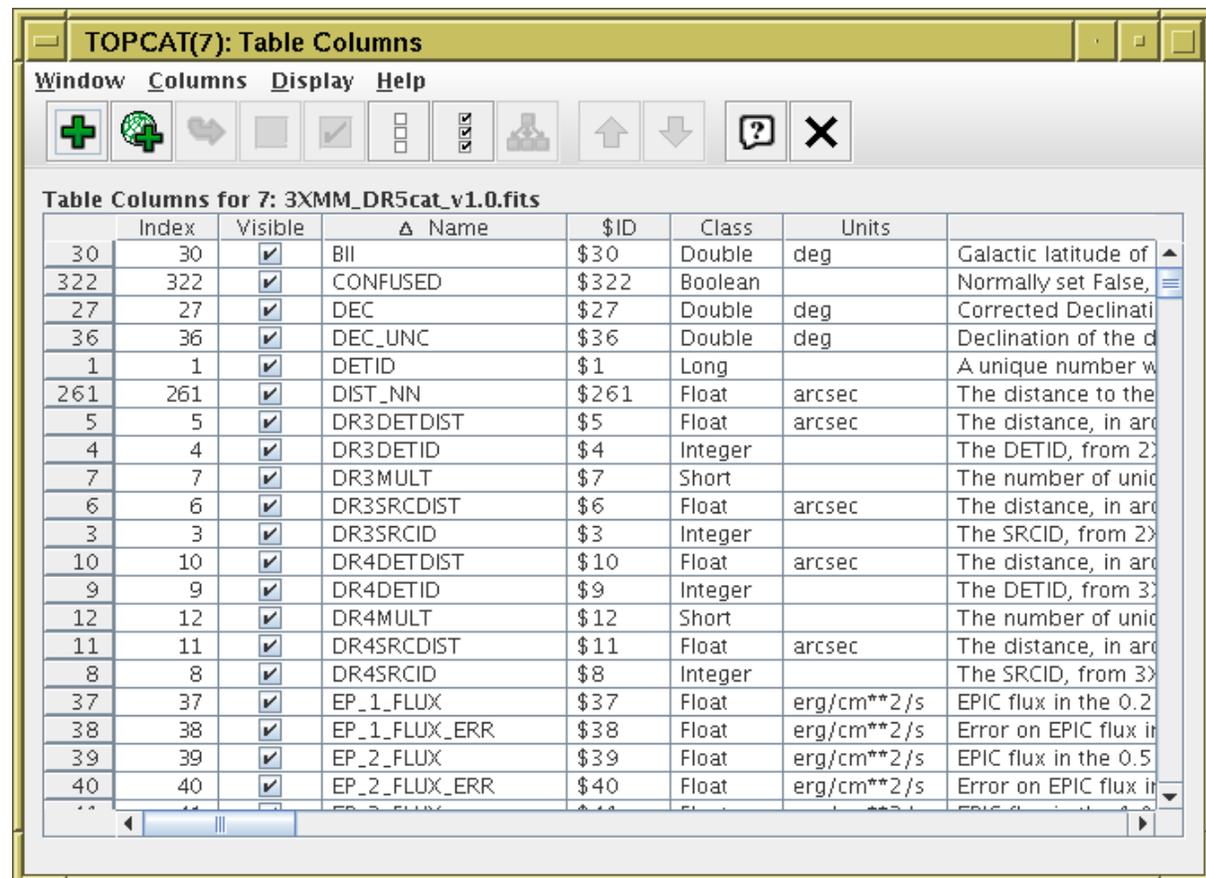
Solution:

- Defined a [private FITS convention](#) (hack) to work round this
 - ▷ Original idea by F-X Pineau, Bill Pence
 - ▷ Extensive discussion on [FITSBITS](#) mailing list (not all of it enthusiastic)
 - ▷ Non-aware FITS readers will just see the first 998 columns (plus big blob in col 999)
- Most people will never come across this
 - ▷ ... but beneficial when it's needed.

Click-to-Sort JTables

You can now reorder displayed rows in some (more) metadata tables:

- Columns, Statistics, Parameters and Subsets windows
- Clicking on header cycles ascending → descending → natural order
- Especially useful for >1000-column tables!
- (This was already present in some other windows, e.g. TAP dialogue)



TOPCAT(7): Table Columns

Window Columns Display Help

Table Columns for 7: 3XMM_DR5cat_v1.0.fits

	Index	Visible	Δ Name	\$ID	Class	Units	
30	30	<input checked="" type="checkbox"/>	Bll	\$30	Double	deg	Galactic latitude of
322	322	<input checked="" type="checkbox"/>	CONFUSED	\$322	Boolean		Normally set False,
27	27	<input checked="" type="checkbox"/>	DEC	\$27	Double	deg	Corrected Declinati
36	36	<input checked="" type="checkbox"/>	DEC UNC	\$36	Double	deg	Declination of the d
1	1	<input checked="" type="checkbox"/>	DETID	\$1	Long		A unique number w
261	261	<input checked="" type="checkbox"/>	DIST_NN	\$261	Float	arcsec	The distance to the
5	5	<input checked="" type="checkbox"/>	DR3DETDIST	\$5	Float	arcsec	The distance, in arc
4	4	<input checked="" type="checkbox"/>	DR3DETID	\$4	Integer		The DETID, from 2>
7	7	<input checked="" type="checkbox"/>	DR3MULT	\$7	Short		The number of unid
6	6	<input checked="" type="checkbox"/>	DR3SRCDIST	\$6	Float	arcsec	The distance, in arc
3	3	<input checked="" type="checkbox"/>	DR3SRCID	\$3	Integer		The SRCID, from 2>
10	10	<input checked="" type="checkbox"/>	DR4DETDIST	\$10	Float	arcsec	The distance, in arc
9	9	<input checked="" type="checkbox"/>	DR4DETID	\$9	Integer		The DETID, from 3>
12	12	<input checked="" type="checkbox"/>	DR4MULT	\$12	Short		The number of unid
11	11	<input checked="" type="checkbox"/>	DR4SRCDIST	\$11	Float	arcsec	The distance, in arc
8	8	<input checked="" type="checkbox"/>	DR4SRCID	\$8	Integer		The SRCID, from 3>
37	37	<input checked="" type="checkbox"/>	EP_1_FLUX	\$37	Float	erg/cm**2/s	EPIC flux in the 0.2
38	38	<input checked="" type="checkbox"/>	EP_1_FLUX_ERR	\$38	Float	erg/cm**2/s	Error on EPIC flux in
39	39	<input checked="" type="checkbox"/>	EP_2_FLUX	\$39	Float	erg/cm**2/s	EPIC flux in the 0.5
40	40	<input checked="" type="checkbox"/>	EP_2_FLUX_ERR	\$40	Float	erg/cm**2/s	Error on EPIC flux in

VOTable

- Default VOTable output is now [VOTable 1.3](#) (was 1.1)
 - You probably won't notice this, but it means COOSYS and BINARY2 are OK
- New BINARY2 serialization format output options added
 - Options now `votable-tabledata`,
`votable-binary-inline`, `votable-binary2-inline`, `votable-fits-inline`,
`votable-binary-href`, `votable-binary2-href`, `votable-fits-href`
- COOSYS handling (see [VOTable 1.3 Erratum #1](#))
 - Metadata now visible in TOPCAT parameter window (`CoosysSystem`, `CoosysEpoch`)
 - COOSYS column metadata now survives VOTable write/read cycles
 - But TOPCAT still doesn't really *do anything* with COOSYS, it leaves that to the user

VO Miscellanea

Minor things:

- Euro-VO RegTAP service added to hard-coded list
 - ▷ Thanks Costas!
- TAP (non-default) registry-based service discovery updated
 - ▷ Now matches *Data Discovery Note v1.1*
- Liberalise TAP example parsing
 - ▷ previously there were problems with DALI 1.0/1.1/TAP Impl Note incompatibilities

Coming Up

- Gaia DR2 (April 2018)
 - **DataLink support** + Activation Action overhaul
 - Propagate coordinates (and errors) to later/earlier epoch using proper motions (and errors)
- Java 8?
 - Would allow use of *streams* → multithreading (visualisation, crossmatch ...)
 - Q: Would Java 8 TOPCAT/STILTS/STIL cause anyone problems?
- Maybe...
 - TAP 1.1 (etc) — is anything required?
 - More TOPCAT/STILTS integration (crossmatch, VO queries, ...)
 - Sky coverage visualisation/manipulation (MOC, STC)
 - More visualisation options (SPLOM, RGB, ...)
 - HTML5 STILTS front end?
 - Time series support?
 - ... *your ideas here* ...