

**GENIUS Mid-Term Review:
WP 440 (VO Tools and Services)
UBR (University of Bristol)**

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Context

- Table analysis software developed in Bristol:
 - TOPCAT: interactive GUI tool for analysis of tables/catalogues
 - STILTS: command-line/batch counterpart of TOPCAT
 - Capabilities: Data acquisition (including VO), visualisation, crossmatching, calculations, manipulation
 - Features: fast, large datasets, easy to use/install, open source
 - Leading science tools used in astronomy for catalogue work (thousands of users in Europe and worldwide)
 - Gaia archive:
 - Key dataset expected to benefit all areas of astronomy
- ⇒ Requirement:
- Ensure seamless access to Gaia archive from these tools

Resources

- Effort: 3 months \times 1 FTE (MBT at UBR)

TOPCAT/Gaia Data Access Overview

- Approach

- Use existing standard data access methods where applicable (don't reinvent the wheel)
- Make sure these function to allow optimal use of Gaia data from TOPCAT/STILTS

- Specifics

- Use existing Table Access Protocol (TAP) client in TOPCAT for custom access to Gaia archive
- Develop new client for CDS X-Match Upload service for bulk positional crossmatches with local tables



Table **A**ccess **P**rotocol

- Suite of protocols developed by IVOA (International Virtual Observatory Alliance)
- In wide use for (especially) large and complex astro catalogue holdings
- Allows remote execution of SQL-like queries
- Includes upload of local tables to remote (Gaia) database for, e.g., crossmatches

Implementation context

- TOPCAT has existing working TAP client
- ESAC will provide TAP+ interface to Gaia catalogue
- Gaia catalogue will also be available from other TAP services (CDS, ARI, AIP, ASDC, more?)

GENIUS work

- Ensure that TOPCAT client works well with GACS TAP+ implementation
- Work with GACS team to run service validators (developed at UBR) as part of service release/deployment cycle, identify and fix TAP bugs/issues
- Ensure that TOPCAT client works well with other Gaia-hosting TAP services

TAP

Table Access Protocol (TAP) Query

Window TAP Edit Interop Help

Select Service Use Service Resume Job Running Jobs

Metadata

Find:

Name Descrip Or

Service	Schema	Table	Columns	FKey	
		Name	Data Type	Unit	
		age	float	Ga	Age of the star.
		alphafe	float		α -Element to Fe abundanc
		bondalbedo	float		Bond albedo for exoplanet
		colorvminusi	float	mag	Intrinsic V-I color.
		eccentricity	float		Orbit eccentricity of a mult
		feh	float		Fe/H abundance ratio.
		flaginteracting	short		True if the object is intera
		geomalbedo	float		Geometric albedo for an e
		hasphotocente...	short		True if the photocenter of
		host	int		1=Milky way, 2=mostly SM
		inclination	float	deg	Orbit Inclination of a multig
		logg	float		Log of surface gravity.
		lonnitudeasce	float	deg	Orbit lonnitude of the asce

Service Capabilities

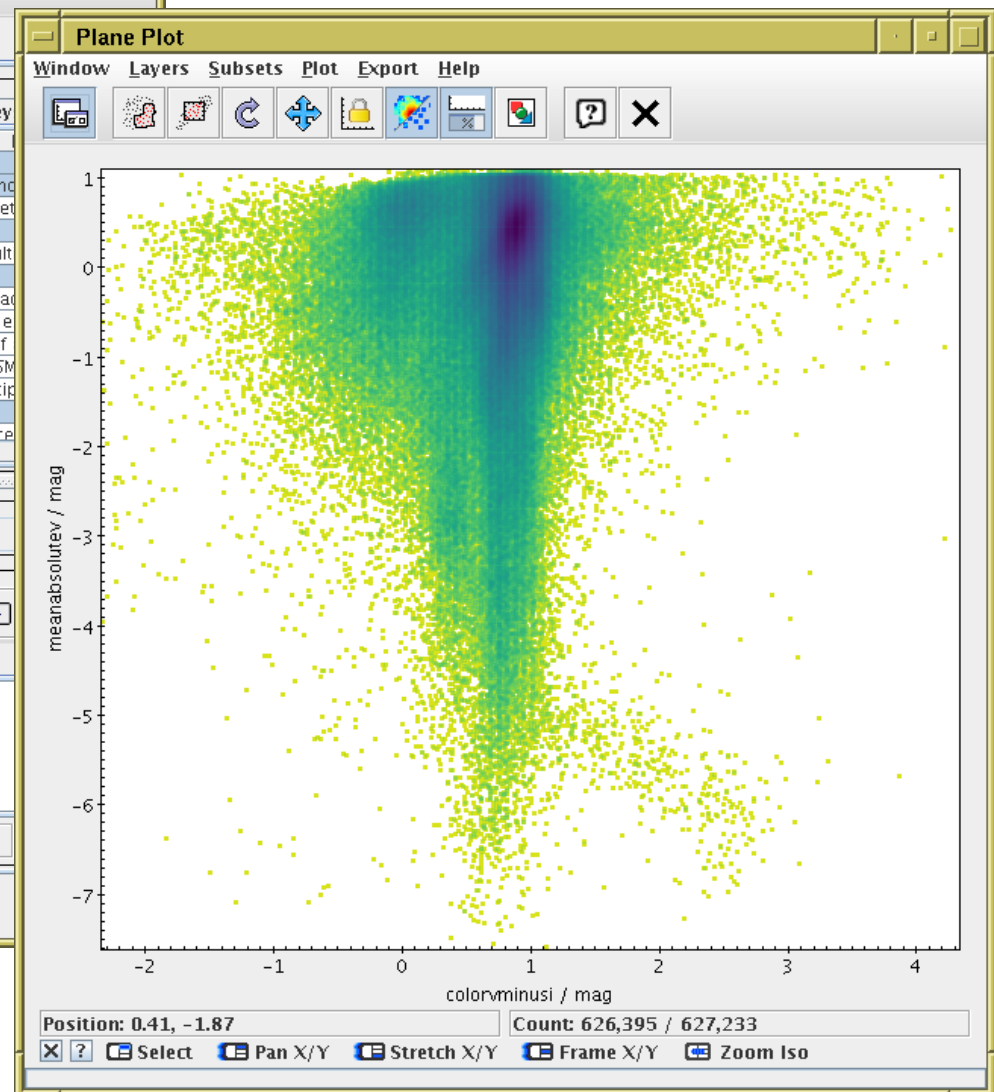
Query Language: ADQL-2.0 Max Rows: 10000000 Uploads: 20Mb

ADQL Text

Mode: Asynchronous

```
SELECT age, alphafe, colorvminusi, feh, logg, mass, mbol, meanabsolutev,
teff, alpha, delta, "distance", magg, spectraltype
FROM gums.smc
WHERE spectraltype = 'G5'
```

Run Query



CDS X-Match

X-Match service deployed by Centre de Données de Strasbourg

- Performs very fast standard positional crossmatches between CDS table and user-uploaded tables ($\lesssim 1$ Mrow)
- CDS/VizieR will host Gaia catalogue

GENIUS work

- Develop TOPCAT/STILTS user interfaces to X-Match service
 - ▷ this makes it easy to match local catalogues with Gaia observations
 - ▷ client-side chunking allows crossmatch of arbitrarily large tables (STILTS)
 - ▷ it will also benefit non-Gaia data users

CDS X-Match

CDS Upload X-Match

Window Search Help

Remote Table

VizieR Table ID/Alias: VI/137/gum_qso

Name: VI/137/gum_qso

Alias:

Description: Gaia Universe Model Snapshot (GUMS) (quasar)

Row Count: 979,315

Coverage: 0.9598796 (order 6)

Local Table

Input Table: 32: dr5qso.fits

RA column: RA degrees (J2000)

Dec column: DEC degrees (J2000)

Match Parameters

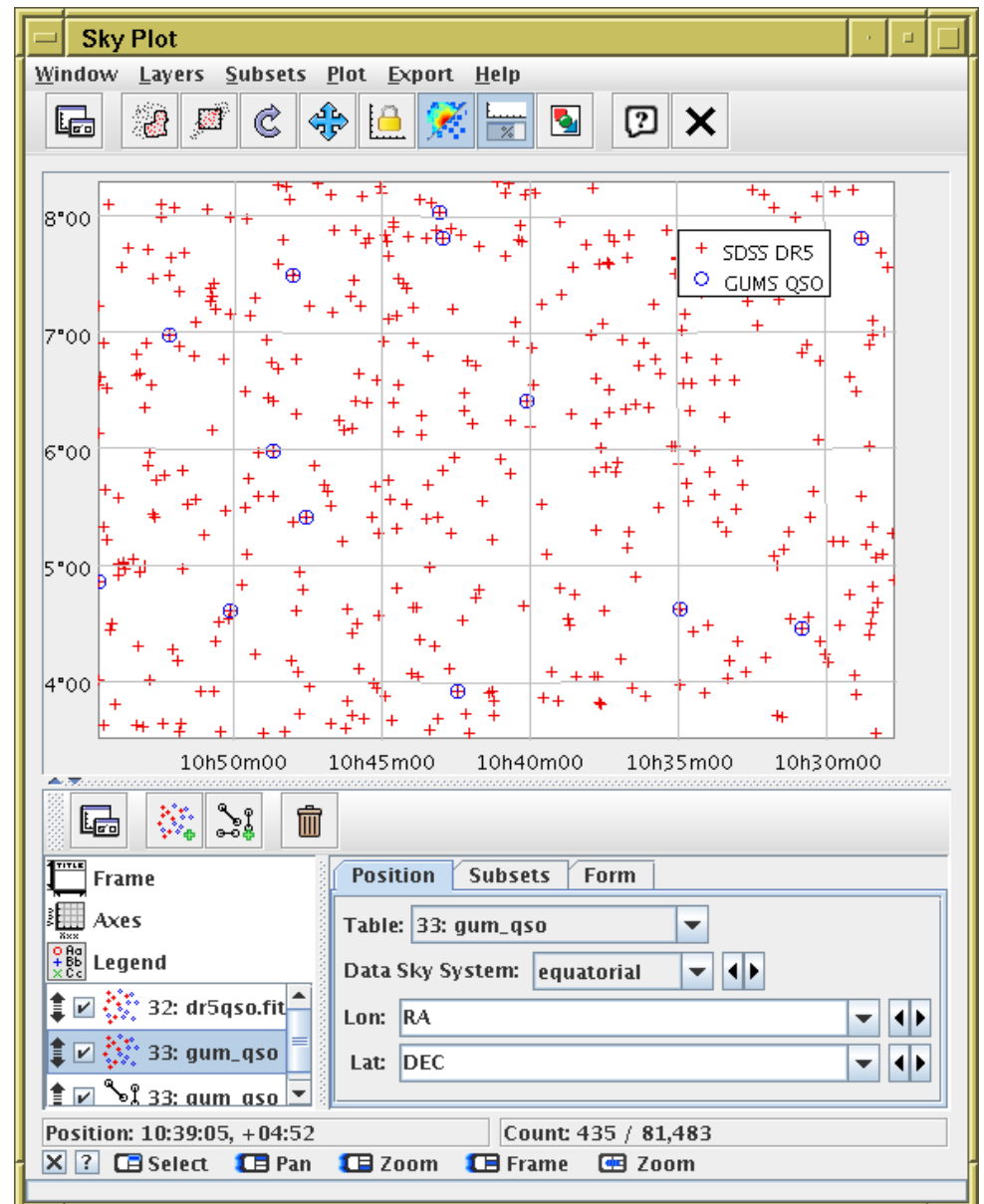
Radius: 2 arcsec

Find mode: All

Rename columns: Duplicates Suffix: _sdss

Block size: 50000

Go Stop



Status

Current Status of planned work:

- ✓ TOPCAT TAP window → GACS: works with GUMS data (GACS v0.5, Dec 2014 makes routine use of `taplint` validation)
- ✓ TOPCAT CDS X-Match window, STILTS `cdsskymatch` command: works with GUMS data (TOPCAT v4.2/STILTS v2.5-3, July 2014)

Additional activities:

- Miscellaneous support (answer technical queries) to GENIUS partners

Planned development work complete

- 3 months FTE expended

Some continuing travel until end of GENIUS project

- e.g. this GENIUS review
- keep in contact with GENIUS community to provide user support for this work, and inform future non-GENIUS work on TOPCAT