

v1.2, 9/8/2017

CASSIS as a spectroscopy tool for VESPA
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Go to VESPA portal

<http://vespa.obspm.fr>

VESPA
Virtual European Solar and Planetary Access

All VO Custom resource Direct Query Advanced Query Help

Submit Reset

Main Parameters

Target Name

Granule UID

Granule GID

Obs ID

Time selection
Data range is included in

Time Min

Target Class
Asteroid
Comet
Dwarf Planet
Exoplanet

Dataproduct Type
Catalog
Cube
Dynamic Spectrum

Measurement Type

Time Max

Location
Spectral

Plotting tools
TOPCAT
Aladin
SPLAT
CASSIS

Example queries
Saturn in March 2012

Click "Submit" to search public data services, or first enter query parameters

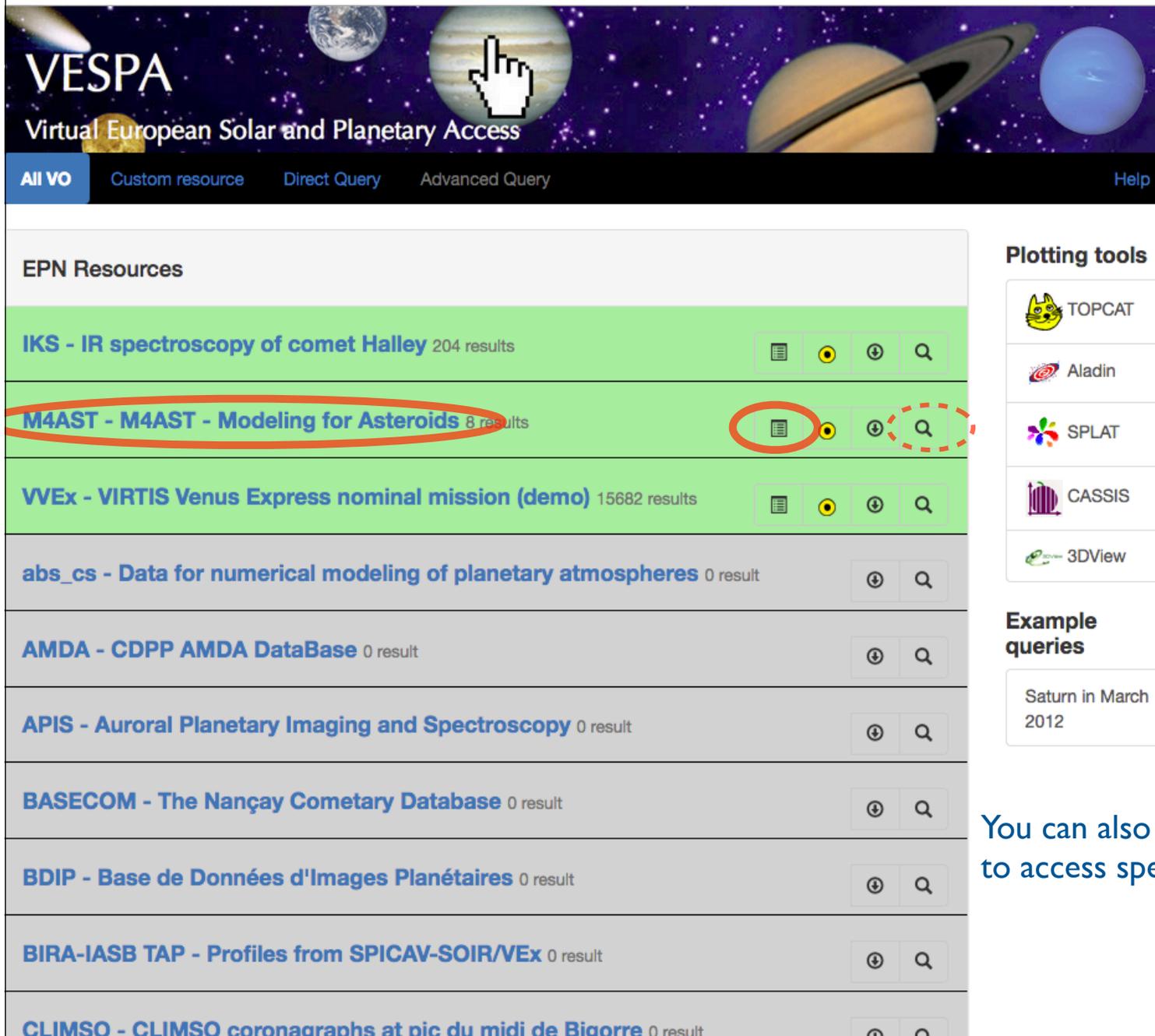
Ex. query parameters:

Target_Name = Jupiter or Ceres or Lutetia
Dataproduct_type = spectrum

VESPA will search all public data services which use the EPN-TAP protocol

Service results

<http://vespa.obspm.fr>



VESPA
Virtual European Solar and Planetary Access

All VO Custom resource Direct Query Advanced Query Help

EPN Resources

IKS - IR spectroscopy of comet Halley 204 results

M4AST - M4AST - Modeling for Asteroids 8 results

VVEx - VIRTIS Venus Express nominal mission (demo) 15682 results

abs_cs - Data for numerical modeling of planetary atmospheres 0 result

AMDA - CDPD AMDA DataBase 0 result

APIS - Auroral Planetary Imaging and Spectroscopy 0 result

BASECOM - The Nançay Cometary Database 0 result

BDIP - Base de Données d'Images Planétaires 0 result

BIRA-IASB TAP - Profiles from SPICAV-SOIR/VEx 0 result

CLIMSO - CLIMSO coronagraphs at pic du midi de Bigorre 0 result

Plotting tools

- TOPCAT
- Aladin
- SPLAT
- CASSIS
- 3DView

Example queries

Saturn in March 2012

On line M4ast, click the "Display results" icon to get result list from this service

You can also click "Advanced query form" to access specific parameters (local time...)

Query results

Result is a list of files matching the query



Results in service M4AST

how entries

Column visibility

Select All in current page

granule_uid	dataproduct_type	target_name	time_min (d)	time_max (d)	access_url	granule_gid	obs_id
Zeissia_19920114_697_00_nativ	spectrum	Zeissia	1992-01-14T00:00:00.000	1992-01-14T00:00:00.000	http://cardamine.imc...	native	Zeissia_19920114_697_00_obs
Zeissia_19920114_697_00	spectrum	Zeissia	1992-01-14T00:00:00.000	1992-01-14T00:00:00.000	http://voparis-srv-p...	formatted	Zeissia_19920114_697_00_obs
Zao_20001026_262_00_nativ	spectrum	Zao	2000-10-26T00:00:00.000	2000-10-26T00:00:00.000	http://cardamine.imc...	native	Zao_20001026_262_00_obs
Zao_20001026_262_00	spectrum	Zao	2000-10-26T00:00:00.000	2000-10-26T00:00:00.000	http://voparis-srv-p...	formatted	Zao_20001026_262_00_obs
Wesson_19911028_697_00_nativ	spectrum	Wesson	1991-10-28T00:00:00.000	1991-10-28T00:00:00.000	http://cardamine.imc...	native	Wesson_19911028_697_00_obs
Wesson_19911028_697_00	spectrum	Wesson	1991-10-28T00:00:00.000	1991-10-28T00:00:00.000	http://voparis-srv-p...	formatted	Wesson_19911028_697_00_obs
Viv_19911028_697_00_nativ	spectrum	Viv	1991-10-28T00:00:00.000	1991-10-28T00:00:00.000	http://cardamine.imc...	native	Viv_19911028_697_00_obs
Viv_19911028_697_00	spectrum	Viv	1991-10-28T00:00:00.000	1991-10-28T00:00:00.000	http://voparis-srv-p...	formatted	Viv_19911028_697_00_obs
Vihuri_19911213_697_00_nativ	spectrum	Vihuri	1991-12-13T00:00:00.000	1991-12-13T00:00:00.000	http://cardamine.imc...	native	Vihuri_19911213_697_00_obs
Vihuri_19911213_697_00	spectrum	Vihuri	1991-12-13T00:00:00.000	1991-12-13T00:00:00.000	http://voparis-srv-p...	formatted	Vihuri_19911213_697_00_obs

howing 1 to 10 of 940 entries 1 row selected

Plotting tools

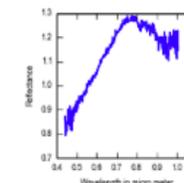
- TOPCAT
- Aladin
- SPLAT
- CASSIS
- 3DView

Click "Show all" to see other parameters

Example queries

Hover the mouse over the table to see thumbnails

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Contact : support.apntap@obspm.fr



Click to select one or more lines & click "Data selection" / Download to retrieve data files [or click "All metadata" / Send table to send complete table to TOPCAT]

Visualising results

Launch VO tools
either from buttons
or from your system



Results in service M4AST

how entries

Column visibility

granule_uid	dataprodct_type	target_name	time_min (d)	time_max (d)	access_url	granule_gid	obs_id
Zeissia_19920114_697_00_nativ	spectrum	Zeissia	1992-01-14T00:00:00.000	1992-01-14T00:00:00.000	http://cardamine.imc...	native	Zeissia_19920114_697_00_obs
Zeissia_19920114_697_00	spectrum	Zeissia	1992-01-14T00:00:00.000	1992-01-14T00:00:00.000	http://voparis-srv-p...	formatted	Zeissia_19920114_697_00_obs
Zao_20001026_262_00_nativ	spectrum	Zao	2000-10-26T00:00:00.000	2000-10-26T00:00:00.000	http://cardamine.imc...	native	Zao_20001026_262_00_obs
Zao_20001026_262_00	spectrum	Zao	2000-10-26T00:00:00.000	2000-10-26T00:00:00.000	http://voparis-srv-p...	formatted	Zao_20001026_262_00_obs
Wesson_19911028_697_00_nativ	spectrum	Wesson	1991-10-28T00:00:00.000	1991-10-28T00:00:00.000	http://cardamine.imc...	native	Wesson_19911028_697_00_obs
Wesson_19911028_697_00	spectrum	Wesson	1991-10-28T00:00:00.000	1991-10-28T00:00:00.000	http://voparis-srv-p...	formatted	Wesson_19911028_697_00_obs
Viv_19911028_697_00_nativ	spectrum	Viv	1991-10-28T00:00:00.000	1991-10-28T00:00:00.000	http://cardamine.imc...	native	Viv_19911028_697_00_obs
Viv_19911028_697_00	spectrum	Viv	1991-10-28T00:00:00.000	1991-10-28T00:00:00.000	http://voparis-srv-p...	formatted	Viv_19911028_697_00_obs
Vihuri_19911213_697_00_nativ	spectrum	Vihuri	1991-12-13T00:00:00.000	1991-12-13T00:00:00.000	http://cardamine.imc...	native	Vihuri_19911213_697_00_obs
Vihuri_19911213_697_00	spectrum	Vihuri	1991-12-13T00:00:00.000	1991-12-13T00:00:00.000	http://voparis-srv-p...	formatted	Vihuri_19911213_697_00_obs

howing 1 to 10 of 940 entries 1 row selected

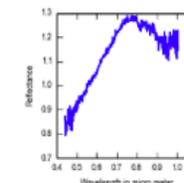
Data Selection

Plotting tools

-  TOPCAT
-  Aladin
-  SPLAT
-  CASSIS
-  3DView

Example queries

CASSIS is the tool of choice for spectra
TOPCAT is an all-purpose tool for tables



CASSIS as a spectrum visualizer in VESPA

In service IKS, select `iksfinal` and `iksfig7` spectra in VOtable format
Or use `"granule_gid = corrected"` in the query

Results in service IKS

Show entries

Column visibility Show all Hide all

Select All in current page Reset Selection

granule_uid	dataproduct_type	target_name	time_min (d)	time_max (d)	access_url
iksfinalC	spectrum	1P	1986-03-06T00:00:00.000	1986-03-06T00:00:00.000	http://voparis-srv.o...
iksfinalA	spectrum	1P	1986-03-06T00:00:00.000	1986-03-06T00:00:00.000	http://pdssbn.astro...
iksfig7C	spectrum	1P	1986-03-06T00:00:00.000	1986-03-06T00:00:00.000	http://voparis-srv.o...
iksfig7A	spectrum	1P	1986-03-06T00:00:00.000	1986-03-06T00:00:00.000	http://pdssbn.astro...
iks193C	spectrum	1P	1986-03-06T00:00:00.000	1986-03-06T00:00:00.000	http://voparis-srv.o...
iks193A	spectrum	1P	1986-03-06T00:00:00.000	1986-03-06T00:00:00.000	http://pdssbn.astro...
iks192C	spectrum	1P	1986-03-06T00:00:00.000	1986-03-06T00:00:00.000	http://voparis-srv.o...
iks192A	spectrum	1P	1986-03-06T00:00:00.000	1986-03-06T00:00:00.000	http://pdssbn.astro...
iks191C	spectrum	1P	1986-03-06T00:00:00.000	1986-03-06T00:00:00.000	http://voparis-srv.o...
iks191A	spectrum	1P	1986-03-06T00:00:00.000	1986-03-06T00:00:00.000	http://pdssbn.astro...

Plotting tools

- TOPCAT
- Aladin
- SPLAT
- CASSIS
- 3DView

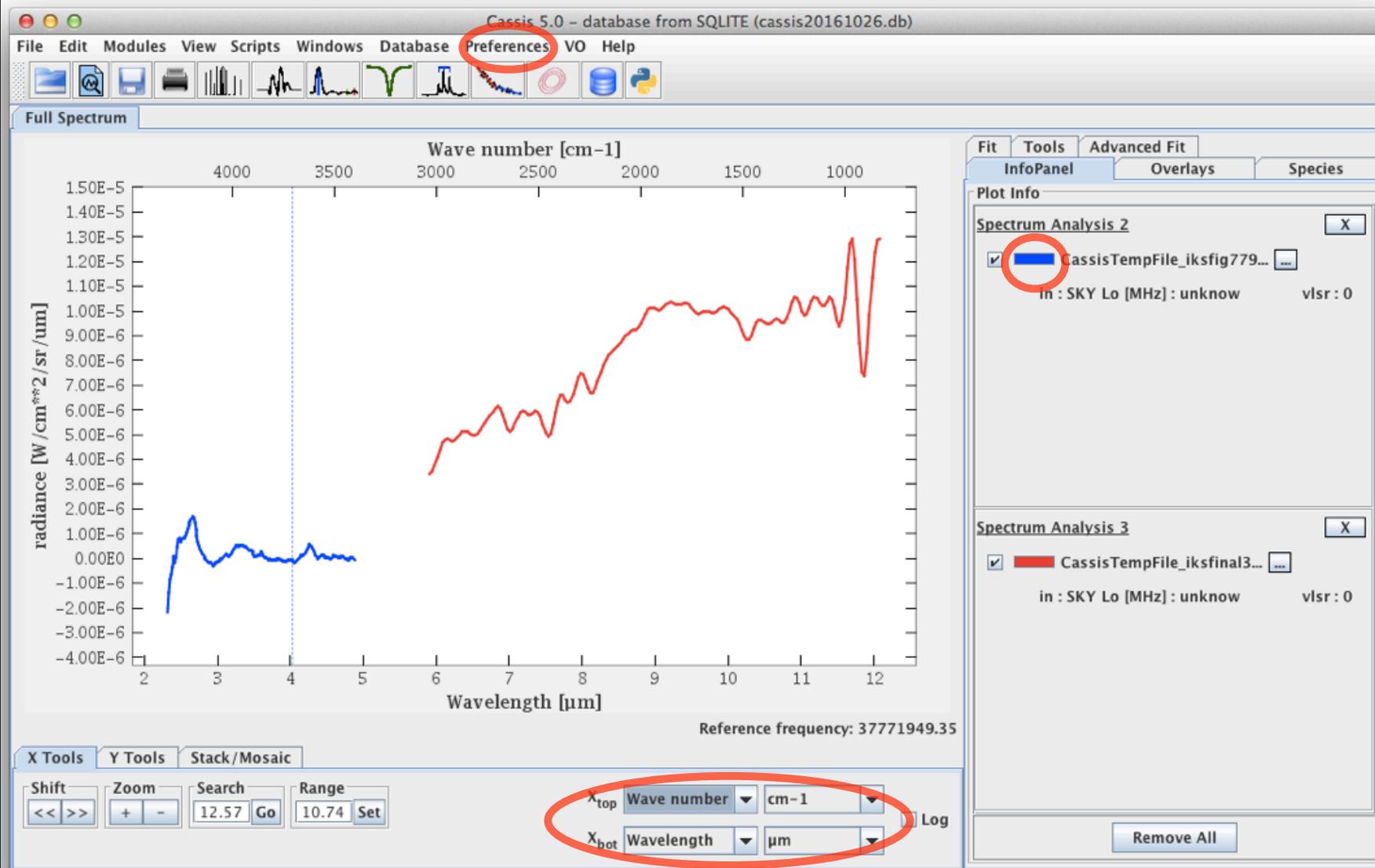
Example queries

Saturn in March 2012

Click to select one or more lines & click "Data selection" / Send spectra to load data into CASSIS
[or / SendTable to load in TOPCAT]

CASSIS as a visualizer

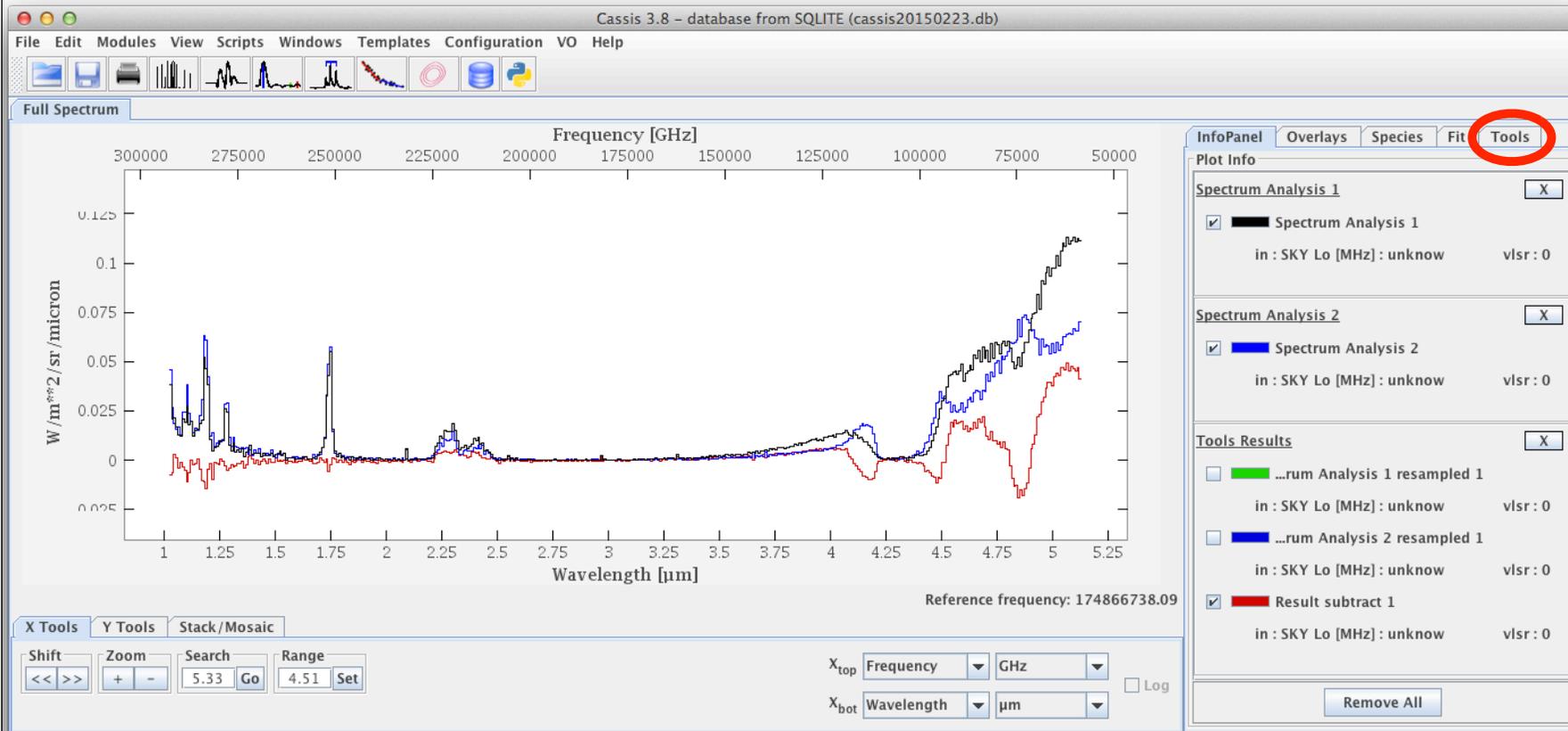
CASSIS receives spectra from search interface, can overplot selections



In Preferences > General set "Force direct opening" to True (this will bypass dialogues)
Adjust color and line style in the panel under the color box
Change units and navigate with lower panel buttons

Visualization and arithmetics in CASSIS

CASSIS can overplot a selection of spectra and manipulate them



Press "shift" to see level at mouse location
Left click or "Comm"-drag to set plotting region
"Alt"-drag to select a region (used in "Fit" tab)
"Alt"-click to set markers (& remove them in InfoPanel)
Mouse-wheel to zoom in/out

Click the "Tools" tab to combine spectra
Spectra are resampled to a common wvl vector on the fly
The "Species" tab accesses line databases (most of them related to the ISM)
Also includes LTE and RADEX modeling

Spectral comparisons from different services

In VESPA, ask for spectra of asteroid Vesta and look in M4ast result page:
Use "target_name = vesta" & "granule_gid = formatted" in the query

Results in service M4AST

Show 10 entries

Column visibility Show all Hide all

Select All in current page Reset Selection

granule_uid	dataproduct_type	target_name	time_min (d)	time_max (d)	access_url
Vesta_20030331_568_01_nativ	spectrum	Vesta	2003-03-31T11:44:59.999	2003-03-31T11:44:59.999	http://cardamine.imc...
Vesta_20030331_568_01	spectrum	Vesta	2003-03-31T11:44:59.999	2003-03-31T11:44:59.999	http://voparis-srv-p...
Vesta_20030331_568_00_nativ	spectrum	Vesta	2003-03-31T10:20:00.000	2003-03-31T10:20:00.000	http://cardamine.imc...
Vesta_20030331_568_00	spectrum	Vesta	2003-03-31T10:20:00.000	2003-03-31T10:20:00.000	http://voparis-srv-p...
Vesta_20030330_568_02_nativ	spectrum	Vesta	2003-03-30T13:09:59.999	2003-03-30T13:09:59.999	http://cardamine.imc...
Vesta_20030330_568_02	spectrum	Vesta	2003-03-30T13:09:59.999	2003-03-30T13:09:59.999	http://voparis-srv-p...
Vesta_20030330_568_01_nativ	spectrum	Vesta	2003-03-30T12:15:59.999	2003-03-30T12:15:59.999	http://cardamine.imc...
Vesta_20030330_568_01	spectrum	Vesta	2003-03-30T12:15:59.999	2003-03-30T12:15:59.999	http://voparis-srv-p...
Vesta_20030330_568_00_nativ	spectrum	Vesta	2003-03-30T10:03:00.000	2003-03-30T10:03:00.000	http://cardamine.imc...
Vesta_20030330_568_00	spectrum	Vesta	2003-03-30T10:03:00.000	2003-03-30T10:03:00.000	http://voparis-srv-p...

cardamine.imcce.fr/m4ast/Spectre/Vesta_20030330_568_02.txt

Plotting tools

- TOPCAT
- Aladin
- SPLAT
- CASSIS
- 3DView

Example queries

Saturn in March 2012

Reflectance vs Wavelength in micrometers

Select preferred results visually from thumbnails

Pick-up VOtable versions (if not already selected in the query)

& send as spectra

Spectral comparisons from different services

In VESPA, ask for spectra of SNC meteorites and look in pds_speclib result page:
Use "granule_gid=natural_meteorite_rock" in the query

The screenshot shows the VESPA Query Interface with the following components:

- Header:** "Virtual European Solar and Planetary Access" with navigation links: All VO, Custom resource, Direct Query, Advanced Query, Help.
- Results in service pds_speclib:** A table with columns: granule_uid, dataproduct_type, target_name, time_min (d), time_max (d), access_url. Three rows are selected (highlighted in blue).
- Plotting tools:** TOPCAT, Aladin, SPLAT, CASSIS, 3DView.
- Example queries:** Saturn in March 2012.
- Thumbnail:** A small plot showing a spectral curve with a red line and a blue shaded area.

granule_uid	dataproduct_type	target_name	time_min (d)	time_max (d)	access_url
SNC_ZAG1_CP_L_C4S47031_0101	spectrum	ZAGAMI	1970-01-01T00:00:00.000	1970-01-01T00:00:00.000	http://voparis-srv.o...
SNC_ZAG1_CP_0_C4S41272_0101	spectrum	ZAGAMI	1970-01-01T00:00:00.000	1970-01-01T00:00:00.000	http://voparis-srv.o...
SNC_SHG1_CP_0_C4S41275_0101	spectrum	SHERGOTTY	1970-01-01T00:00:00.000	1970-01-01T00:00:00.000	http://voparis-srv.o...
SNC_NAK1_CP_0_C4S47028_0101	spectrum	NAKHLA	1970-01-01T00:00:00.000	1970-01-01T00:00:00.000	http://voparis-srv.o...
SNC_LAF1_CP_0_C4S47030_0101	spectrum	LAFAYETTE	1970-01-01T00:00:00.000	1970-01-01T00:00:00.000	http://voparis-srv.o...
SNC_GOVAL1_CP_C4S47058_0101	spectrum	GOVERNADOR_VALADARES	1970-01-01T00:00:00.000	1970-01-01T00:00:00.000	http://voparis-srv.o...
MGP075	spectrum	CHASSIGNY	1989-12-15T00:00:00.000	1989-12-15T00:00:00.000	http://voparis-srv.o...
LAMT05	spectrum	LOS_ANGELES	2000-04-14T00:00:00.000	2000-04-14T00:00:00.000	http://voparis-srv.o...
CGP071	spectrum	EETA79001	1987-07-01T00:00:00.000	1987-07-01T00:00:00.000	http://voparis-srv.o...
CBLM07	spectrum	ALH84001	1988-05-24T00:00:00.000	1988-05-24T00:00:00.000	http://voparis-srv.o...

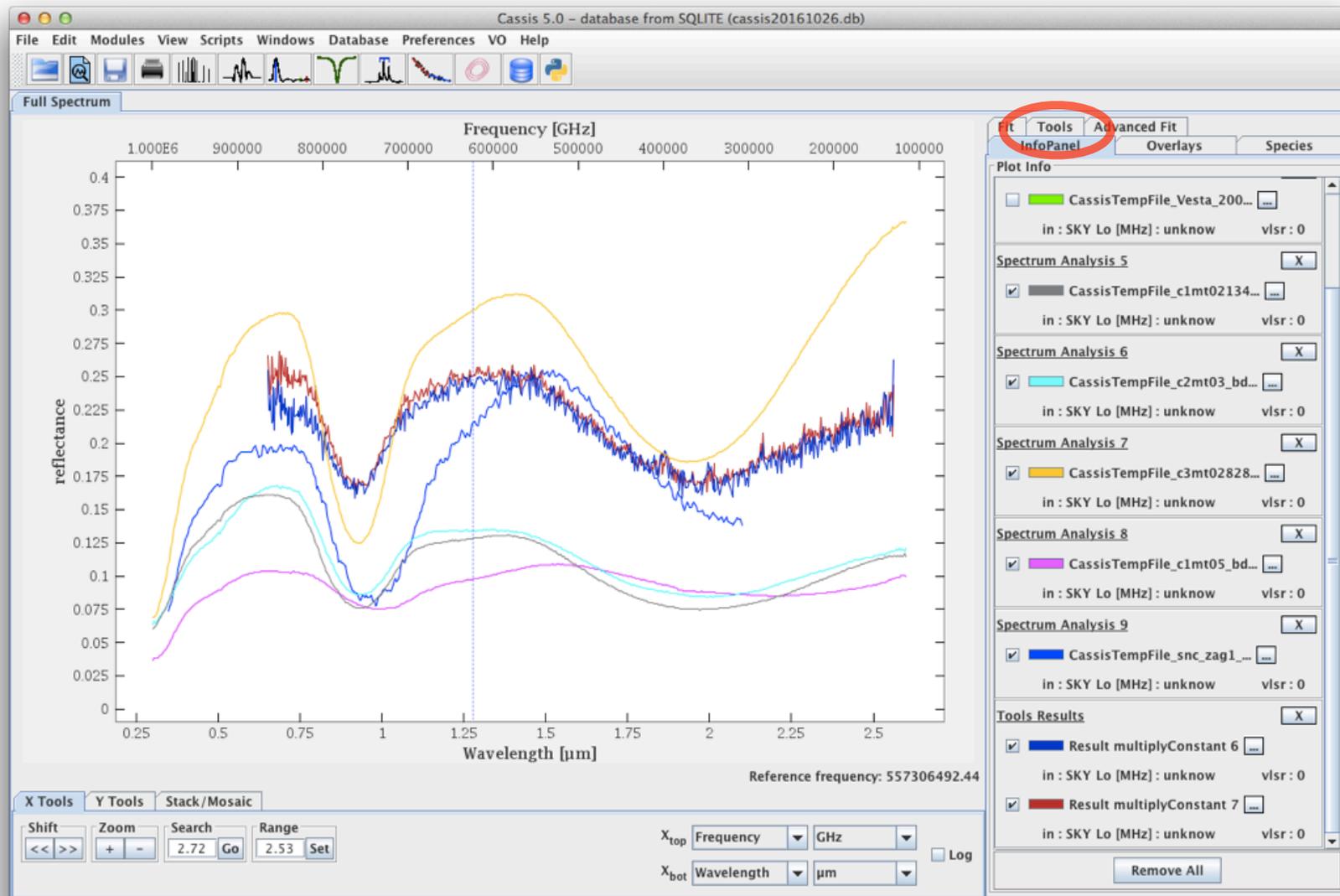
Showing 1 to 10 of 23 entries 3 rows selected

Select preferred results visually from thumbnails
& send as spectra

Spectral comparisons from different services

All spectra will plot immediately in the same window

Spectral axis units will be converted if needed



Use Tools tab to scale flux axis (multiply M4ast spectra by 0.25)

Scaling is required, as Vesta spectra are provided as normalized I/F, and SNC spectra as reflectance factor

Analyzing spectral cubes with APERICubes & CASSIS

APERICubes is a PDS spectral cube viewer for the VIRTIS instrument

see Tuto_TopCat_VEx for details - <http://voplus.obspm.fr/apericubes/js9/demo.php>

APERICubes Demonstrator - a tool for exploring VIRTIS cubes

Version 1.7 by Renaud Sevalle

Cube Import

Choose the PDS file to be processed and click on Process:

V0072_05.CAL Process with GDL

The results of the processing will be displayed in the Results frame.

Process

Results

Processing file: /var/www/apericubes/pds/V0072_05.CAL
Output directory: /var/www/apericubes/js9/pds/V0072_05

SAMP Apps

Cassio
EIS
VIGSpec

SAMP Status

SAMP status: Not connected

Image (JS9 Help)

Name: 0 75 1.75114011176452037

File View Zoom Scale Color Region WCS

Analysis Help

Send Image via SAMP

Region Stats

Region Stats

Position: x 26.50 y 36.13
width 7.50 height 7.50
min 0.10 max 0.12
counts 0.34
bglevel 0.11 noise 0.30
Centroid: x 26.49 y 34.39
FWHM 4.29

3D Plot

X Proj

X Projection

sum

Spectrum

Spectrum for pixel (41,28)

Send Spectrum via SAMP

Extract a spectrum and click on the "Send spectrum via SAMP" button (this can be averaged in a region of interest)

The spectrum extracted from the cube will be sent to CASSIS (as well as TOPCAT, SpecView, etc) for further analysis

Cassio 3.8 - database from SQLITE (cassio20150223.db)

File Edit Modules View Scripts Windows Templates Configuration VO Help

Full Spectrum

Frequency [GHz]

Wavelength [μm]

Reference frequency: 174866738.09

InfoPanel | Overlays | Species | Fit | Tools

Plot Info

Spectrum Analysis 1

Spectrum Analysis 1
in: SKY Lo [MHz]: unknown vlsr: 0

Spectrum Analysis 2

Spectrum Analysis 2
in: SKY Lo [MHz]: unknown vlsr: 0

Tools Results

...rum Analysis 1 resampled 1
in: SKY Lo [MHz]: unknown vlsr: 0

...rum Analysis 2 resampled 1
in: SKY Lo [MHz]: unknown vlsr: 0

Result subtract 1
in: SKY Lo [MHz]: unknown vlsr: 0

Remove All

X Tools Y Tools Stack/Mosaic

Shift Zoom Search Range

<< >> + - 5.33 Go 4.51 Set

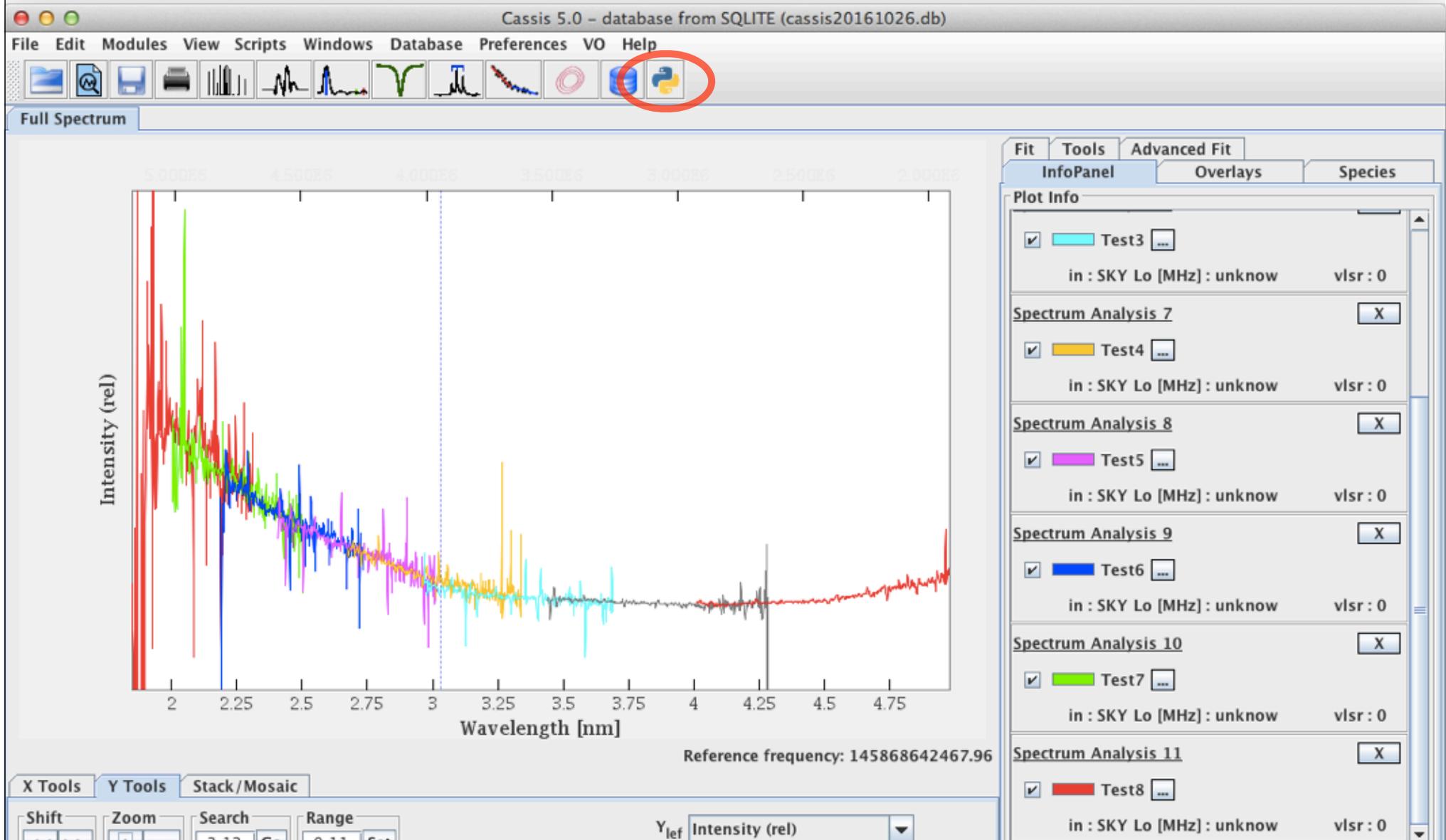
X_top Frequency GHz Log

X_bot Wavelength μm

Special uses in CASSIS

With adequate script CASSIS can plot spectral segments independently

In this case, 8 overlapping spectral orders from VIRTIS-H/Rosetta in the same file
(the default is to merge overlapping regions)



CASSIS as a VO search tool

Select EPN-TAP under the VO menu to access VESPA-compliant data services

The ADQL query is filled automatically from exposed parameter fields, but can be edited manually

You can select several services (Comm-click) in the left list to query them together

An SSA client is also available for more general astronomy services (SSA protocol)

The screenshot shows the CASSIS 5.0 interface with the 'VO' menu highlighted. The 'EPN-TAP' service is selected, and the 'Query parameters' section is visible. The 'Dataproduct type' is set to 'Spectrum'. The 'Query for the selected service(s)' section contains the following ADQL query:

```
SELECT * FROM #tablename# WHERE (dataprodct_type LIKE 'spectrum' OR dataprodct_type LIK E 'sp')
```

The 'Send query' button is visible. Below the query, a table of results is displayed for the 'iks' service. The table has the following columns: sun_distance_min, sun_distance_max, earth_distance_min, earth_distance_max, time_min, time_max, target_time_min, target_time_max, time_scale, time_sampling_step_min, and tirr. The table contains 20 rows of data.

radiance [W/cm²/sr/um]

sun_distance_min	sun_distance_max	earth_distance_min	earth_distance_max	time_min	time_max	target_time_min	target_time_max	time_scale	time_sampling_step_min	tirr
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN
0.79	0.79	1.15	1.15	2446495.5	2446495.5	NaN	NaN	UTC	NaN	NaN

Service URL Table name

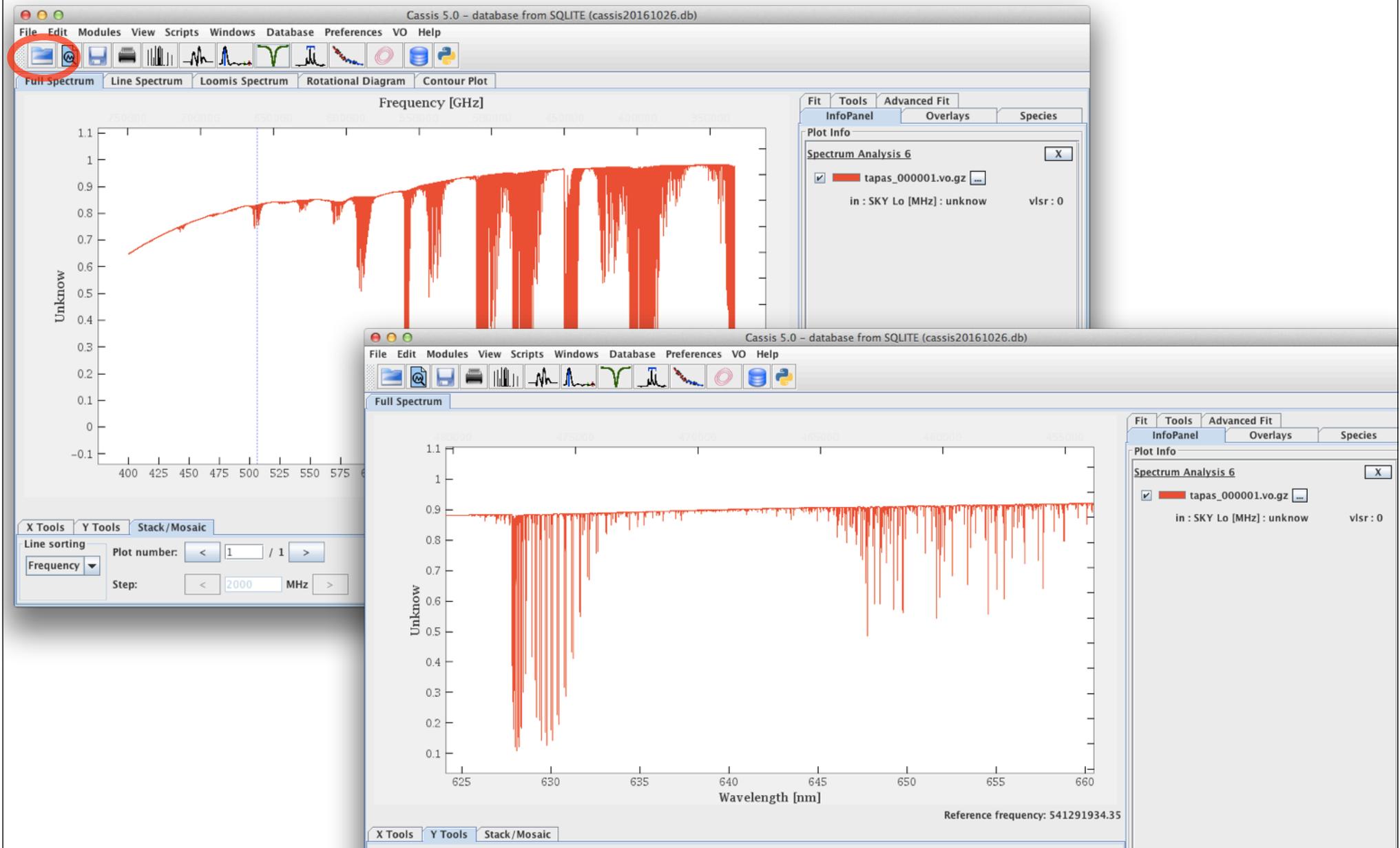
VO Table data parsed

Select spectra, click on "Display" and confirm default access parameter

Use with external (not VO) services

Get a simulated Earth atmosphere transmission spectrum from TAPAS

<http://www.pole-ether.fr/tapas/> (requires registration) - ask for a VOTable output, open it in CASSIS



Use with external (not VO) services

Get a Titan atmosphere spectrum from Planetary Spectrum Generator

<https://ssed.gsfc.nasa.gov/psg/> (requires manual configuration) and retrieve the standard ascii output

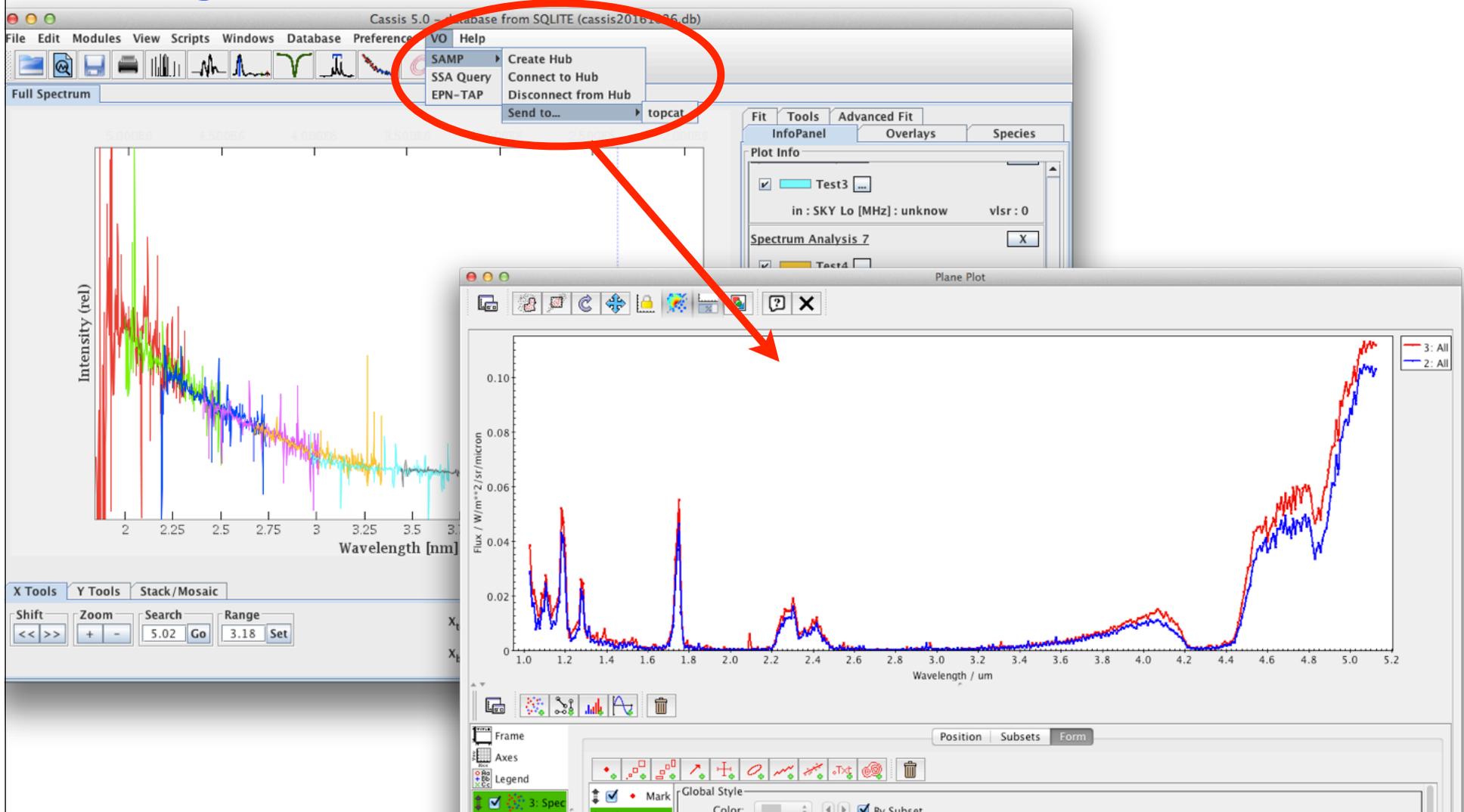
The screenshot displays the Cassis 5.0 software interface. The main window shows a plot of the full spectrum with Wave number [cm⁻¹] on the top x-axis and Wavelength [Ångström] on the bottom x-axis. The y-axis represents flux in W/sr/m²/cm⁻¹. A red circle highlights the 'File' menu icon, and a red arrow points from it to the 'Cassis Spectrum' panel in the Spectrum Manager. The Spectrum Manager panel shows a tree view of resources, including 'User3_rad.txt'. The 'Cassis Metadata' tab is selected, showing a table of metadata with the following data:

Name	Value	Comment	Unit
vlsr	0.0		km/s
LoFreq	0.0		MHz
FILE_TYPE	ASCII		
Spectrum index	0		
Wave unit	Frequency		MHz
Flux unit	T		K
Telescop			MHz
From	/Users/serard/Desk...		

Enter correct quantities and units in CASSIS metadata panel

Click SpectrumManager and go to CASSIS metadata tab, fix wave & flux unit lines as provided in the file

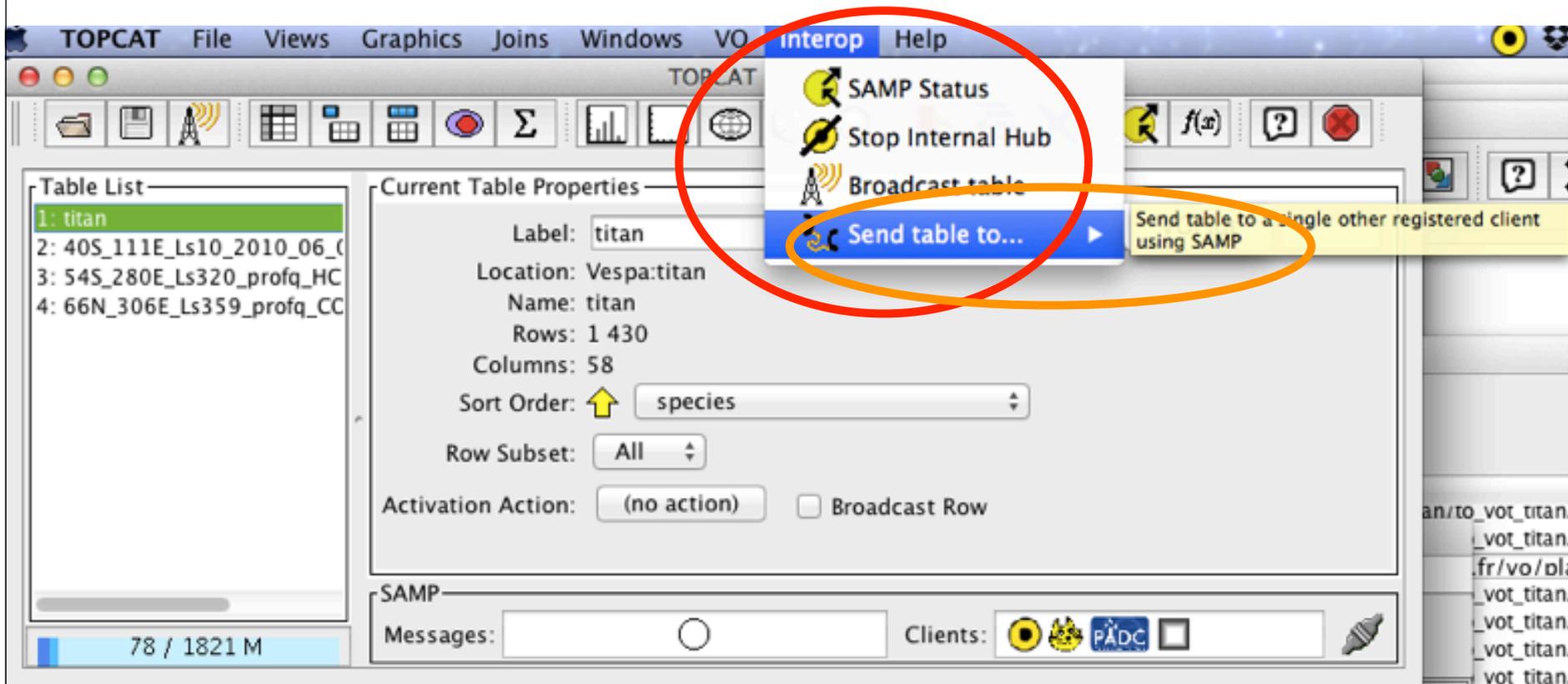
Sending data from CASSIS



With TOPCAT (or SPLAT-VO, VOspec, SpecView, etc) activated, select SAMP > Send to... > topcat in VO menu

In TOPCAT, click on PlanePlot (units may be converted in the process)

Sending data from TOPCAT



Use menu item Interop > Send table to.... in TOPCAT

A table is transmitted to other VO plotting tools

Will open in CASSIS if format is adequate (2 columns with known units)

Going through TOPCAT may help ingesting spectral data that do not enter CASSIS easily

Other relevant tutorials

Tuto_Spectro

EPN-TAP spectroscopy data services in VESPA,
use with various spectral tools

Tuto_TopCat_VEx

Imaging spectroscopy from Venus-Express,
CASSIS interaction with APERICubes

QGIS_plugin

https://github.com/ept-vespa/tutorials/blob/master/vo_qgis_plugin/vo-qgis-plugin.md

Imaging spectroscopy of Mars from CRISM,
sending spectra from TAPhandle or QGIS to CASSIS

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<http://www.europlanet-vespa.eu/>