

v1.0, 18/3/2017

EPN-TAP services: Spectroscopy
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Go to VESPA web site

<http://vespa.obspm.fr>

The screenshot shows the VESPA web interface. At the top, there is a navigation bar with the VESPA logo and the text "Virtual European Solar and Planetary Access". Below this, there are several tabs: "All VO" (circled in red), "Custom resource", "Direct Query", "Advanced Query", and "Help". Below the navigation bar, there are "Submit" and "Reset" buttons. The main content area is divided into several sections:

- Main Parameters:** This section contains several input fields and dropdown menus:
 - Target Name:** A text input field (circled in red).
 - Granule UID:** A text input field.
 - Granule GID:** A text input field.
 - Obs ID:** A text input field.
 - Time selection:** A dropdown menu with the text "Data range is included in".
 - Time Min:** A text input field with a calendar icon.
 - Target Class:** A dropdown menu with options: Asteroid, Comet, Dwarf Planet, Exoplanet.
 - Dataproduct Type:** A dropdown menu (circled in red) with options: Catalog, Cube, Dynamic Spectrum.
 - Measurement Type:** A text input field.
 - Time Max:** A text input field with a calendar icon.
- Plotting tools:** A vertical list of icons and labels: TOPCAT, Aladin, SPLAT, and CASSIS.
- Example queries:** A box containing the text "Saturn in March 2012".
- Location:** A dropdown menu with the option "Spectral" (circled in red).

- Check "All VO" to access public data services

- Enter search parameters:

e.g.:

Target_Name = Jupiter or Ceres or Lutetia

Dataproduct_type = spectrum

(possibly Granule_ID = "formatted" to get only VOTables)

- Specifies ranges

Open "Spectral" panel

Select preferred unit (frequency or wavelength)

Enter min / max values

Go to VESPA web site

<http://vespa.obspm.fr>

The screenshot shows the VESPA web interface. At the top, there is a navigation bar with 'All VO' selected, and links for 'Custom resource', 'Direct Query', 'Advanced Query', and 'Help'. Below this is a 'Submit' button (circled in red) and a 'Reset' button. The main content area is divided into several panels: 'Main Parameters', 'Location', 'Spectral' (circled in red), 'Time', 'Photometry', and 'Instrument'. The 'Spectral' panel contains a 'Data range' dropdown set to 'Data range intersects with', a 'Unit' dropdown set to 'μm' (circled in red), and input fields for 'Spectral Range Min' (1), 'Spectral Range Max' (3), 'Spectral Resolution Min', 'Spectral Resolution Max', 'Spectral Sampling Step Min', and 'Spectral Sampling Step Max'. To the right of the 'Spectral' panel is a 'Plotting tools' section with icons for TOPCAT, Aladin, SPLAT, CASSIS, and 3DView. Below that is an 'Example queries' section with a button for 'Saturn in March 2012'.

- Check "All VO" to access public data services

Example queries

Saturn in March 2012

- Specifies ranges

Open "Spectral" panel
Select preferred unit (frequency or wavelength)
Enter min / max values & type of coverage

- Click "Submit" when ready

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

- In line M4ast, click the "Display results" icon to get result list

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

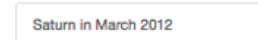
howing 1 to 10 of 940 entries 1 row selected

Plotting tools

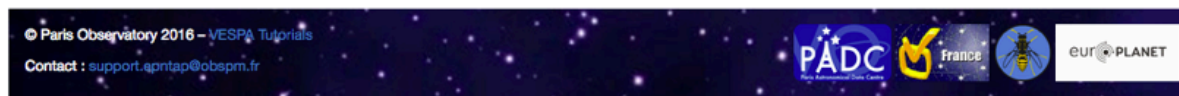


- Click "Show all" to see other parameters

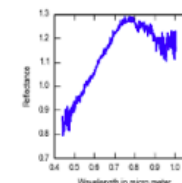
Example queries



- Hover the mouse over the table to see thumbnails



- Click link in "access_url" column to see one file
- Click to select one or more lines & click "Data selection" / Download to retrieve the files



Analysing results

Launch VO tools either from buttons or from your system



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

Showing 1 to 10 of 940 entries 1 row selected

Data Selection

Plotting tools

- TOPCAT
- Aladin
- SPLAT
- CASSIS
- 3DView

Example queries

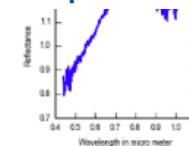
Saturn in March 2012

Favorite tools include:

Aladin & DS9: images & cubes

TOPCAT: tables & catalogues

CASSIS & SPLAT/Specview/VOspec: spectra



Query results

Result is a list of files matching the query



Results in service M4AST

how 10 entries

Column visibility Show all Hide all

Select All in current page Reset Selection

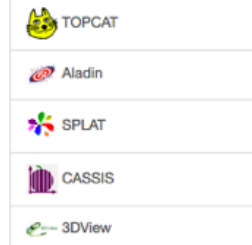
granule_uid	dataproduct_type	target_name	time_min (d)	time_max (d)	access_url	granule_gid	obs_id
Zeissia_19920114_697_00_nativ	spectrum	Zeissia	1992-01-14T00:00:00.000	1992-01-14T00:00:00.000	http://cardamine.imc...	native	Zeissia_19920114_697_00_obs
Zeissia_19920114_697_00	spectrum	Zeissia	1992-01-14T00:00:00.000	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 Metadata Selection All Data All Metadata

Footprints

Plotting tools

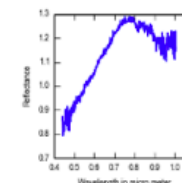
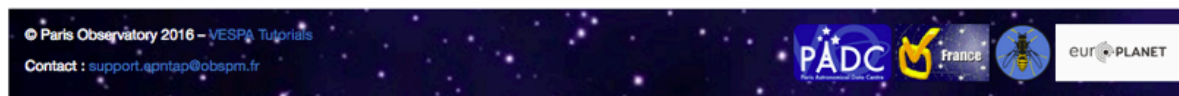


Example queries

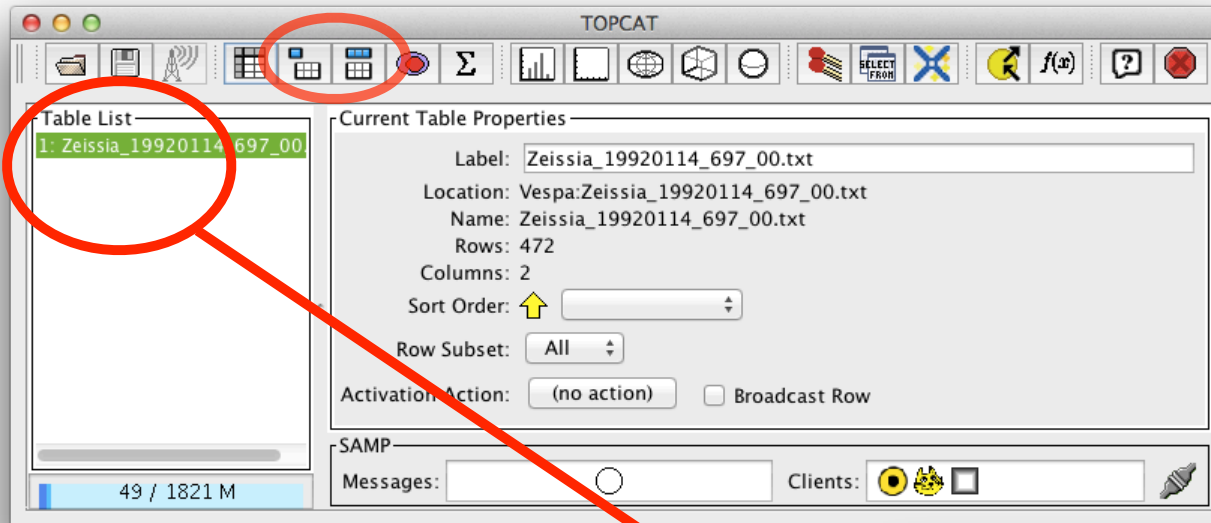
Saturn in March 2012

- Hover the mouse over the table to see thumbnails

- Click to select one or more lines & click "Data selection" / Send spectra to load data into CASSIS or VOSpec, or / Send Table to load in TOPCAT [- or click "All metadata" / Send table to send complete table to TOPCAT]



Visualizing data



In TOPCAT,
double-click table
name to open it

Click menu buttons
to get description of fields

	Wavelength	reflectance
1	0,4875	0,89802
2	0,4895	0,89208
3	0,4905	0,90198
4	0,4915	0,87723
5	0,4926	0,88317
6	0,4936	0,89406
7	0,4946	0,88911
8	0,4956	0,8901
9	0,4966	0,89109
10	0,4977	0,89406
11	0,4987	0,90495
12	0,4997	0,92376
13	0,5007	0,91881
14	0,5017	0,93366
15	0,5027	0,92475
16	0,5038	0,92178
17	0,5048	0,9099
18	0,5058	0,91683
19	0,5068	0,92277
20	0,5078	0,92178
21	0,5089	0,93861
22	0,5099	0,9396
23	0,5109	0,93267
24	0,5119	0,93168
25	0,5129	0,94356
26	0,5139	0,9505
27	0,515	0,9396
28	0,516	0,94257
29	0,517	0,95446
30	0,518	0,9604
31	0,519	0,97921
32	0,5201	0,97525

Visualizing data

TOPCAT

Table List

- 1: vvex

Current Table Properties

Label: vvex

Location: Europlanet client:vvex

Name: vvex

Rows: 1 000 (996 apparent)

Columns: 49

Sort Order: \downarrow c2min

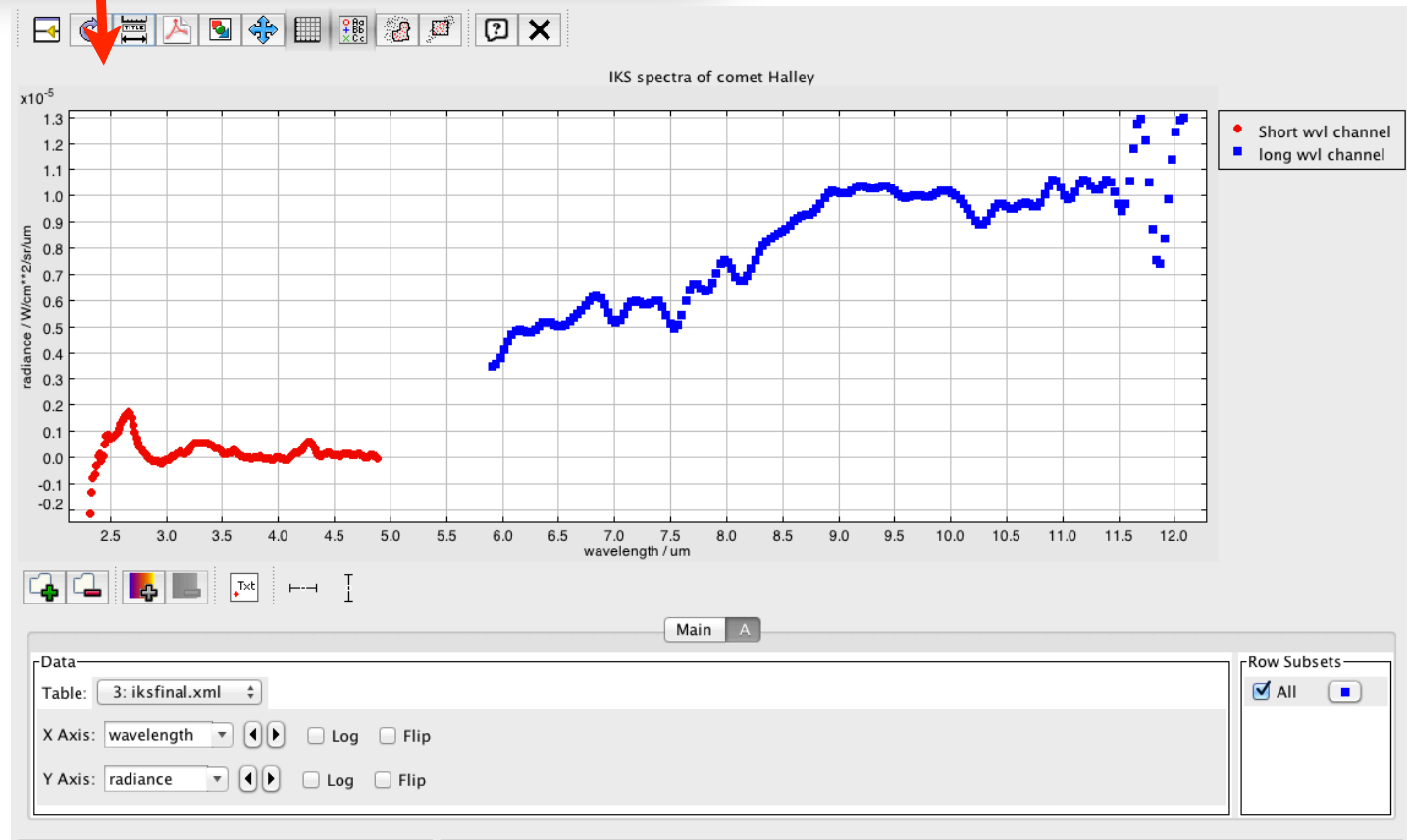
Row Subset: OK2

Activation Action: image(access_url) Broadcast Row

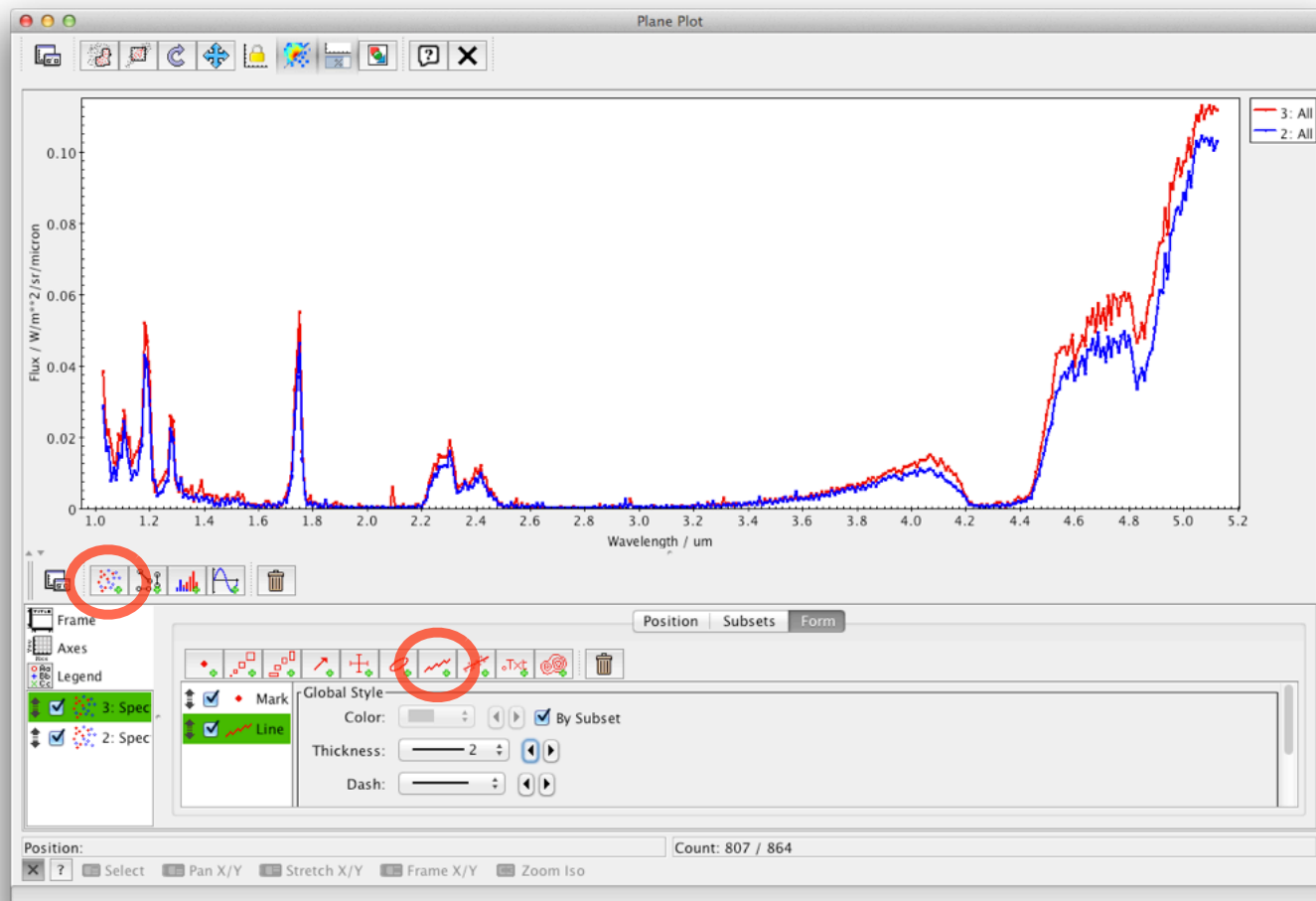
SAMP

Messages: Clients:

In TOPCAT,
click "Plane Plot"
to display spectra



TOPCAT as a spectral tool



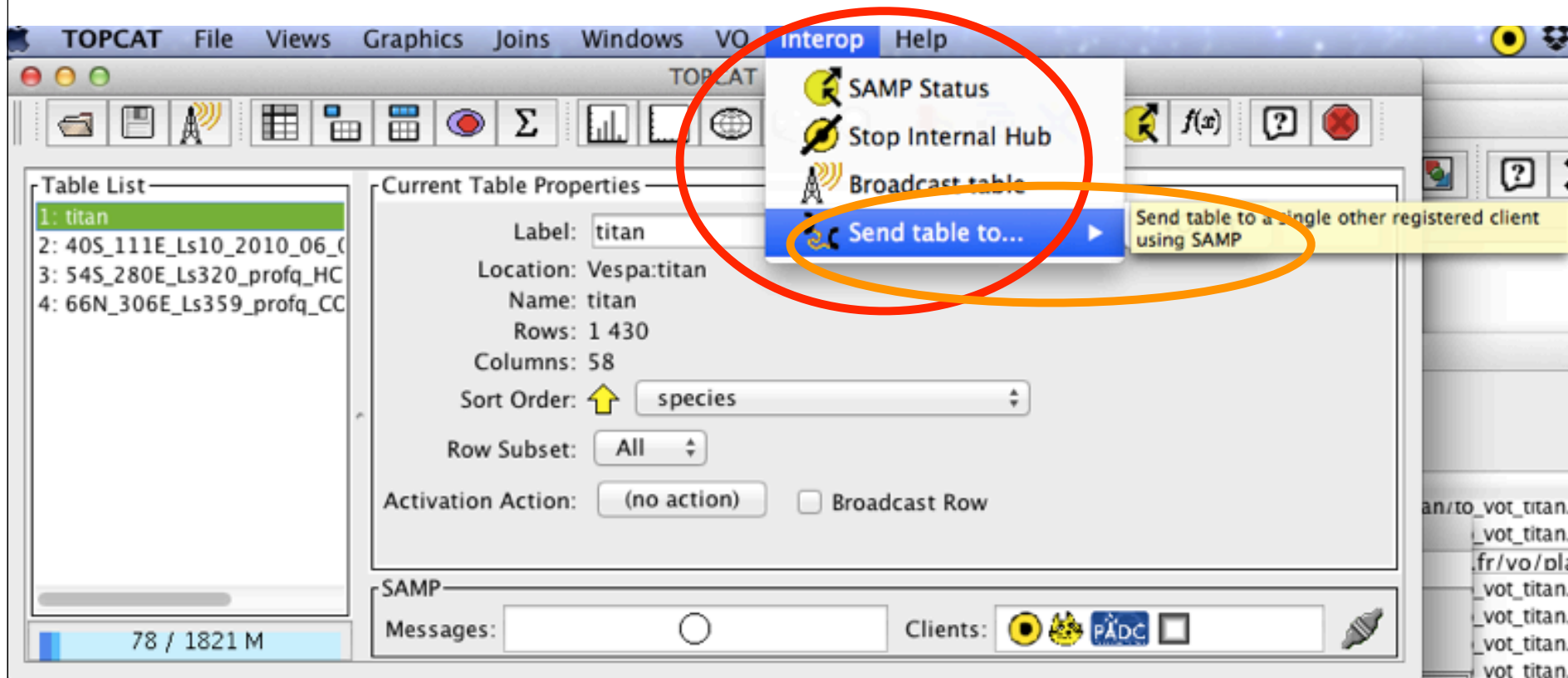
TOPCAT receives spectra from search interface, can overplot selections

Use "Plane plot" & check parameters

Click "New line form" to connect spectral channels

Click "Add new plot" to overplot spectra

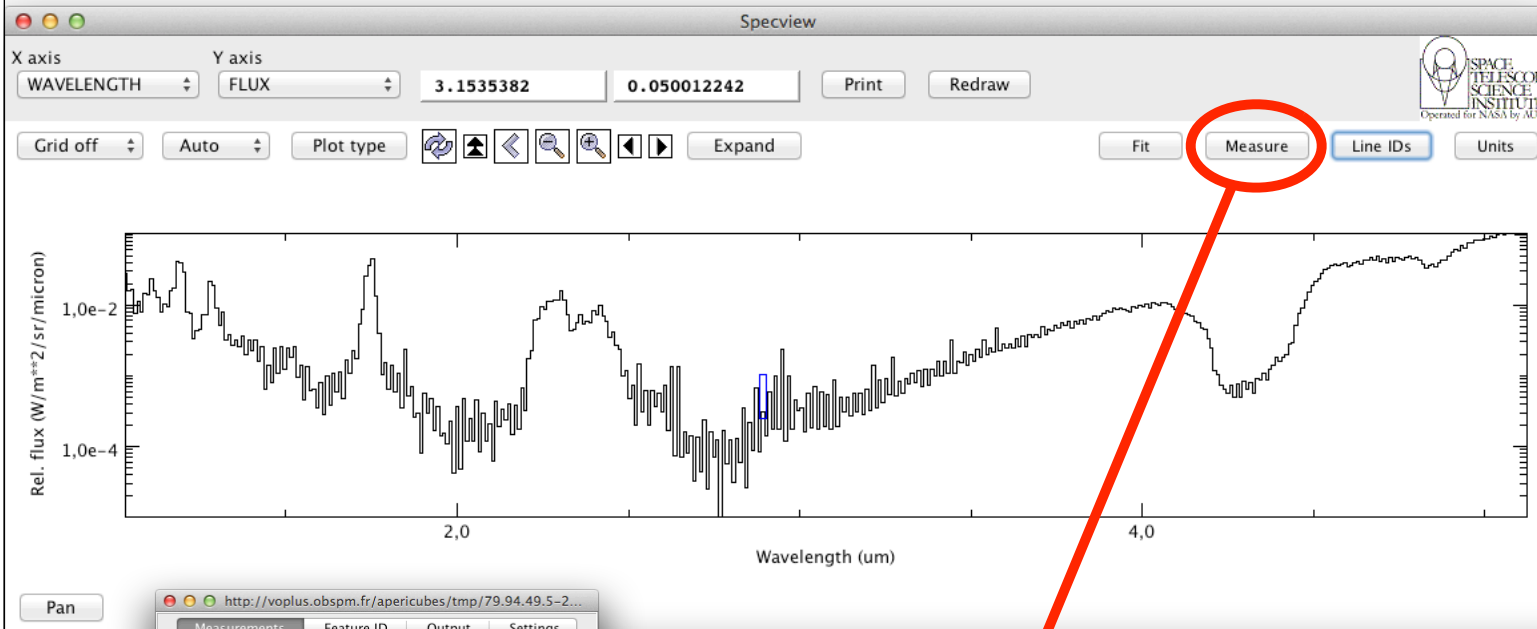
Sending data from TOPCAT



A table can be transmitted to other VO plotting tools, e.g. CASSIS or SpecView (possibly after modification)

Spectral tools: Specview

Specview receives spectra from interface
Includes analysis functions

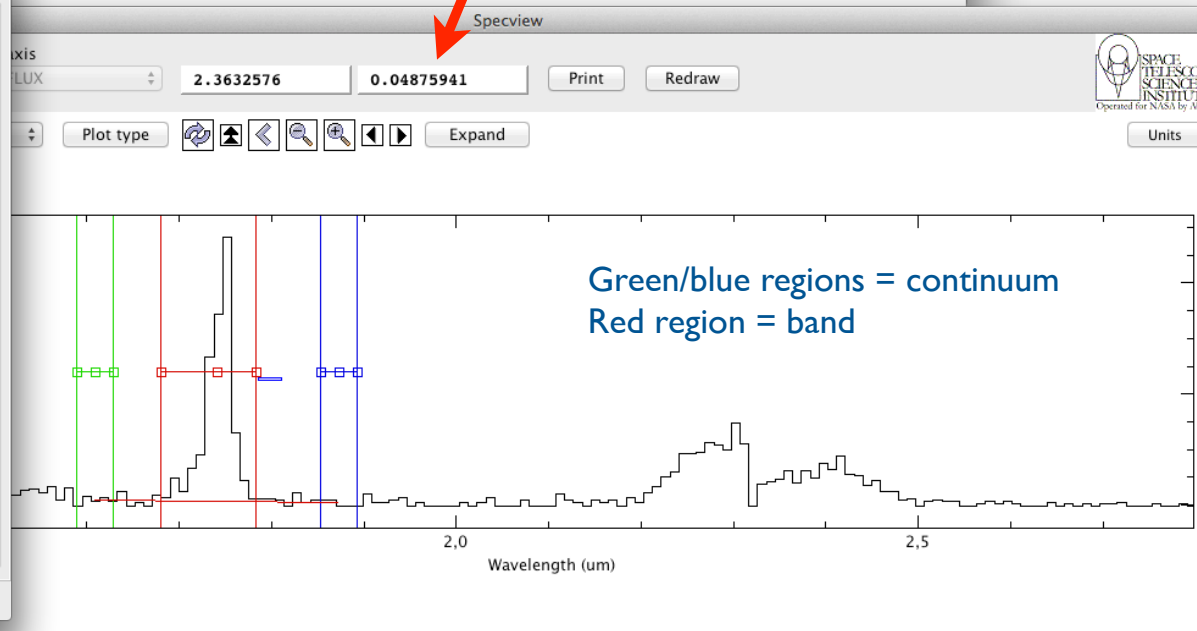


Click on "Measure" to perform continuum and band measurements

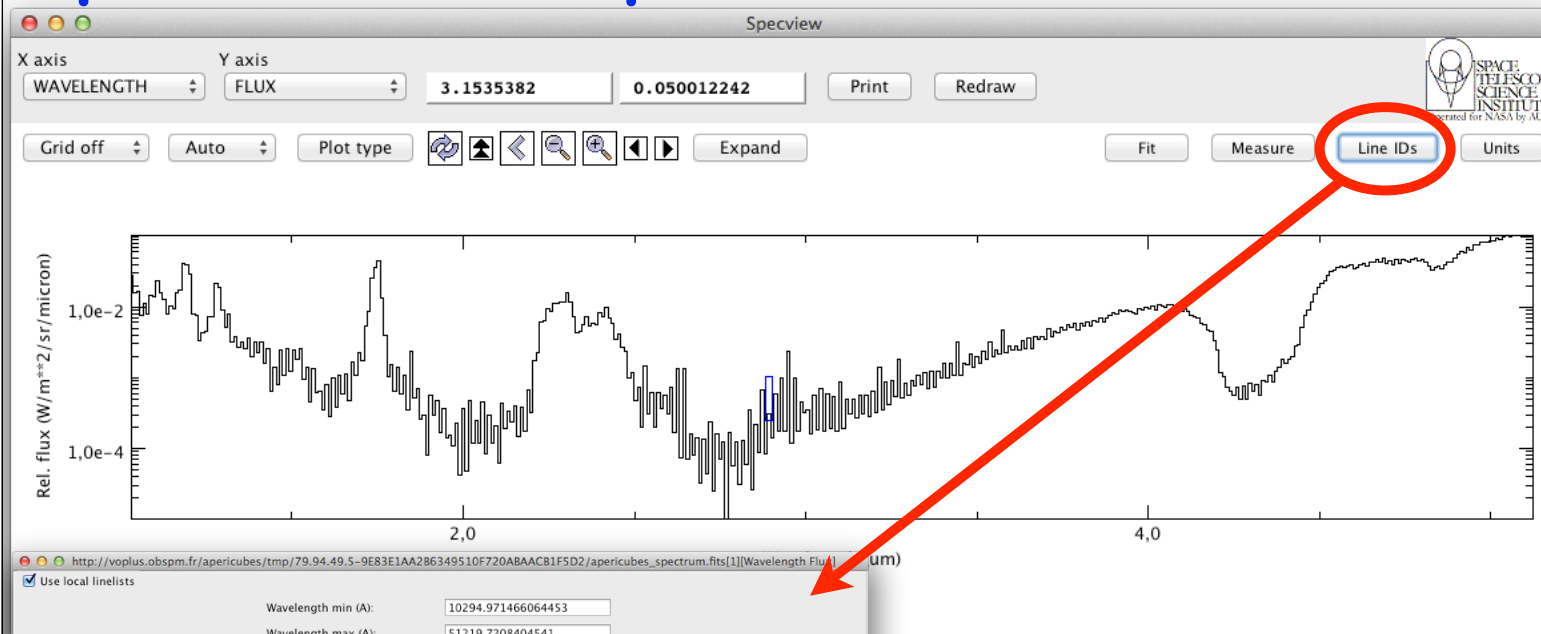
Measurements

Quantity	Value	Error	Units
Net flux	0.14541		W/m**2/sr/mi...
Eq.width	1.80005E14		Angstrom
Flux weight. po...	17412.03569		Angstrom
Extremum posi...	17511.40117		Angstrom
RV (flux w.)			km/s
RV (extremum)			km/s
RV (handle)			km/s
Total flux	0.15304		W/m**2/sr/mi...
Avg. flux density	0.01292		W/m**2/sr/mi...
Handle position	17401.47470		Angstrom
Handle value	0.02412		W/m**2/sr/mi...
Lower limit	16794.20642		Angstrom
Upper limit	17823.92220		Angstrom
Number of bins	12.0		
Continuum 1	9.27409E-4	6.59692E-4	W/m**2/sr/mi...
Cont.1 lower limit	15883.30400		Angstrom
Cont.1 upper li...	16279.34853		Angstrom
Cont. 1 handle...	16081.32627		Angstrom
Cont. 1 handle...	0.02412		W/m**2/sr/mi...
Continuum 2	4.46717E-4	6.11867E-4	W/m**2/sr/mi...
Cont.2 lower limit	18523.60087		Angstrom
Cont.2 upper li...	18919.64540		Angstrom
Cont. 2 handle...	18721.62313		Angstrom
Cont. 2 handle...	0.02412		W/m**2/sr/mi...

Record Dismiss

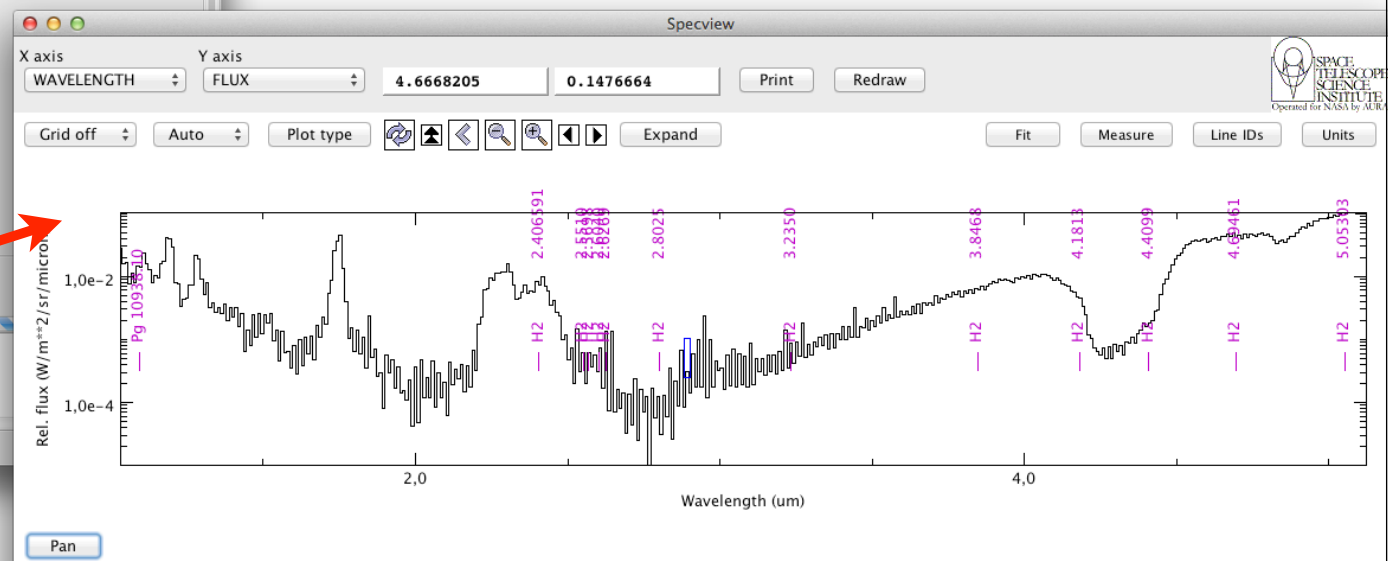


Spectral tools: Specview



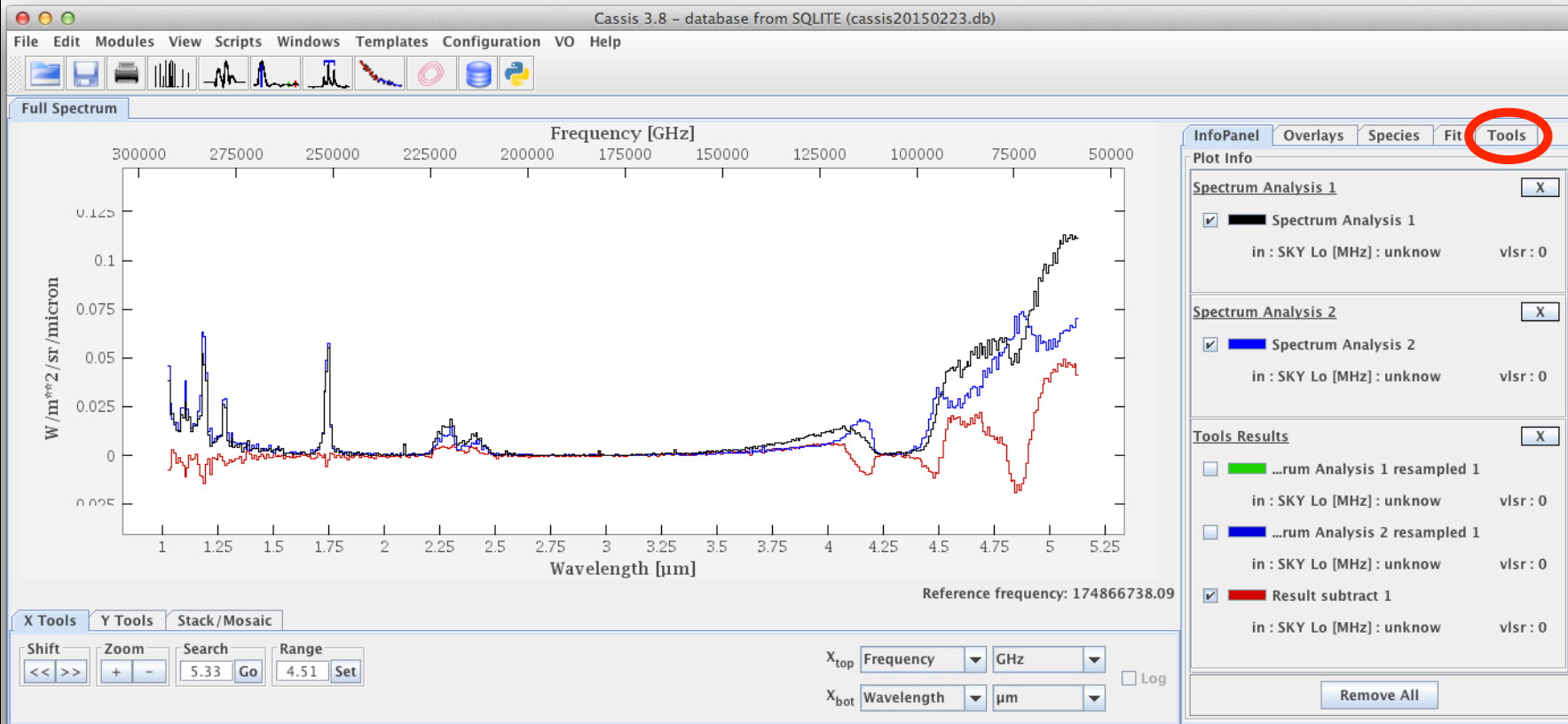
Click on "Line IDs" to query band line databases (from VAMDC) - pick up relevant ones

The VAMDC search interface is shown below the main plot. It includes a search bar for 'Molecule0' with the chemical name 'water' entered. The 'OK' button is circled in red. The interface also shows options for 'Atom0', 'Collision', and 'Particles'. The number of radiative lines is 10000. The data source is listed as 'vamdcmssl.ucl.ac.uk' and 'cdms.ph1.uni-koeln.de'.



Spectral tools: CASSIS

CASSIS receives spectra from interface, can overplot a selection of spectra and manipulate them

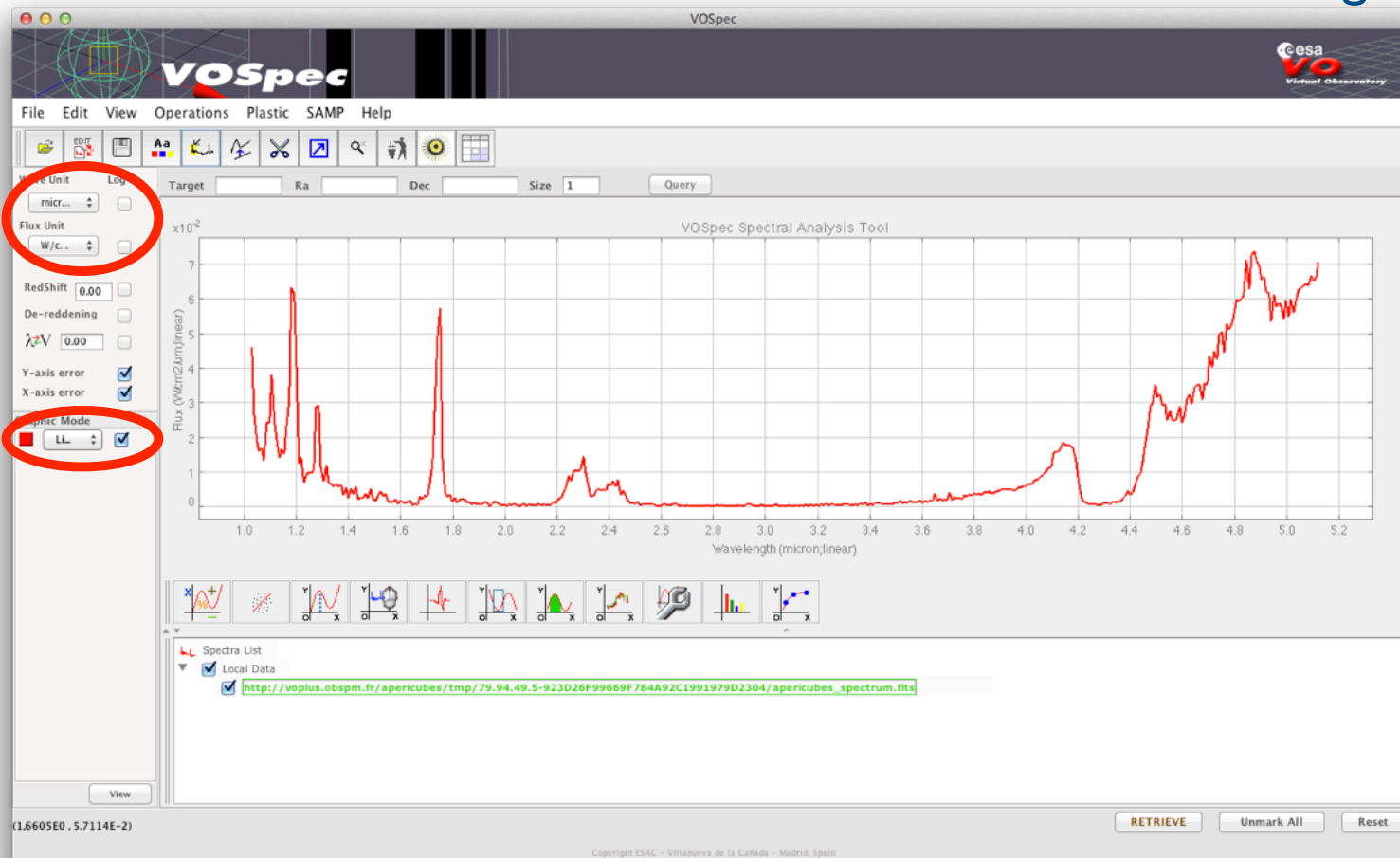


Press "shift" to get info on mouse location
"Alt"-drag to select a region (used in "Fit" tab)
"Alt"-click to put markers

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

Spectral tools: VOSpec

VOSpec receives spectra from interface, but does not recognize units



Select Wavelength in micron
& Flux in $W/m^2/\mu m$ in input pannel
Then uncheck "Log" in axes & reselect
" $W/m^2/\mu m$ " in flux menu
Select "Line" to connect channels

Currently does not understand radiance ($W/m^2/sr/\mu m$)
or reflectance - being discussed with ESA & IVOA

Spectral tools: VOSpec

The VOSpec interface displays a spectral plot of Flux (W/m²/um/linear) versus Wavelength (micron, linear). A prominent peak is labeled "Fe I 14834.314 A". The toolbar includes a "Simple Line Access" button (circled in red). The "Slap Viewer" window shows a tree view of spectral databases and a table of NIST Atomic Spectra data.

NIST ATOMIC SPECTRA							
Idm:Lin...	Idm:Lin...	Idm:Lin...	Idm:Lin...	Idm:Lin...	Idm:Lin...	Idm:Lin...	Idm:Lin...
1.8405...	Ti I 18...	Ti	3d3.(4...	3d3.(4...	1.840...	8.6805...	9.759...
1.8407...	Ne I 18...	Ne	2s2.2p...	2s2.2p...	1.840...	3.2108...	3.318...
1.8407...	Ti II 18...	Ti	3d2.(3...	3d.(2D...	1.840...	1.3003...	1.408...
1.8408...	Ar II 18...	Ar	3s2.3p...	3s2.3p...	1.840...	4.0764...	4.184...
1.8408...	Ar II 18...	Ar	3s2.3p...	3s2.3p...	1.840...	4.0764...	4.184...
1.8409...	Cs II 1...	Cs	5p5.(2...	5p5.(2...	1.840...	3.3599...	3.467...
1.8412...	Cs II 1...	Cs	5p5.(2...	5p5.(2...	1.841...	3.3599...	3.467...
1.8413...	Fe I 18...	Fe	3d7.(4...	3d7.(4...	1.841...	1.0582...	1.166...
1.8413...	Ti I 18...	Ti	3d2.(1...	3d4 3...	1.841...	5.9424...	7.021...
1.8415...	Ti I 18...	Ti	3d2.(1...	3d4 3...	1.841...	5.9671...	7.045...

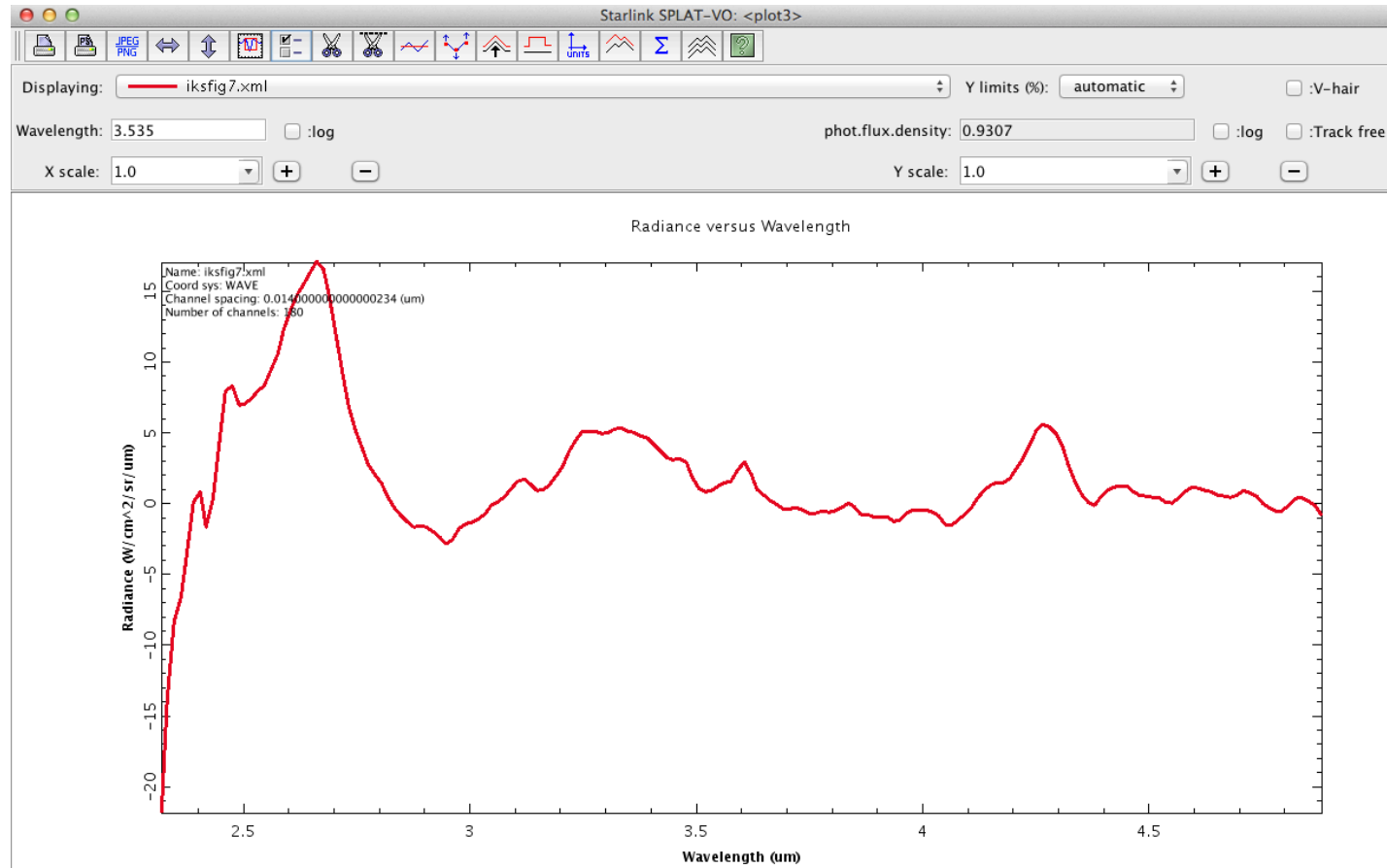
- Click "Simple Line Access" button
- Select area of interest
- Select spectral databases in new window
- Once loaded, lines are identified on mouse-over

Fitting functions available in "Operations" menu

Uses an older protocol which retrieves all lines in a given range => long and busy
Databases mostly related to the ISM (atoms)

Spectral tools: SPLAT-VO

SPLAT-VO receives spectra
from interface
Includes analysis functions



Future developments

- Add search parameters for spectra of lab samples
Enlarge to include sample and setup descriptions
- Better support for spectra in CASSIS and other tools (requires definitions for reflectance spectroscopy)
- Compare observational and lab data, test fitting procedures
- Support band lists in solid phase, for rapid identification of signatures?

The Europlanet 2020 Research Infrastructure project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 654208.

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