EPN-TAP services: Virtis / Venus Express demo

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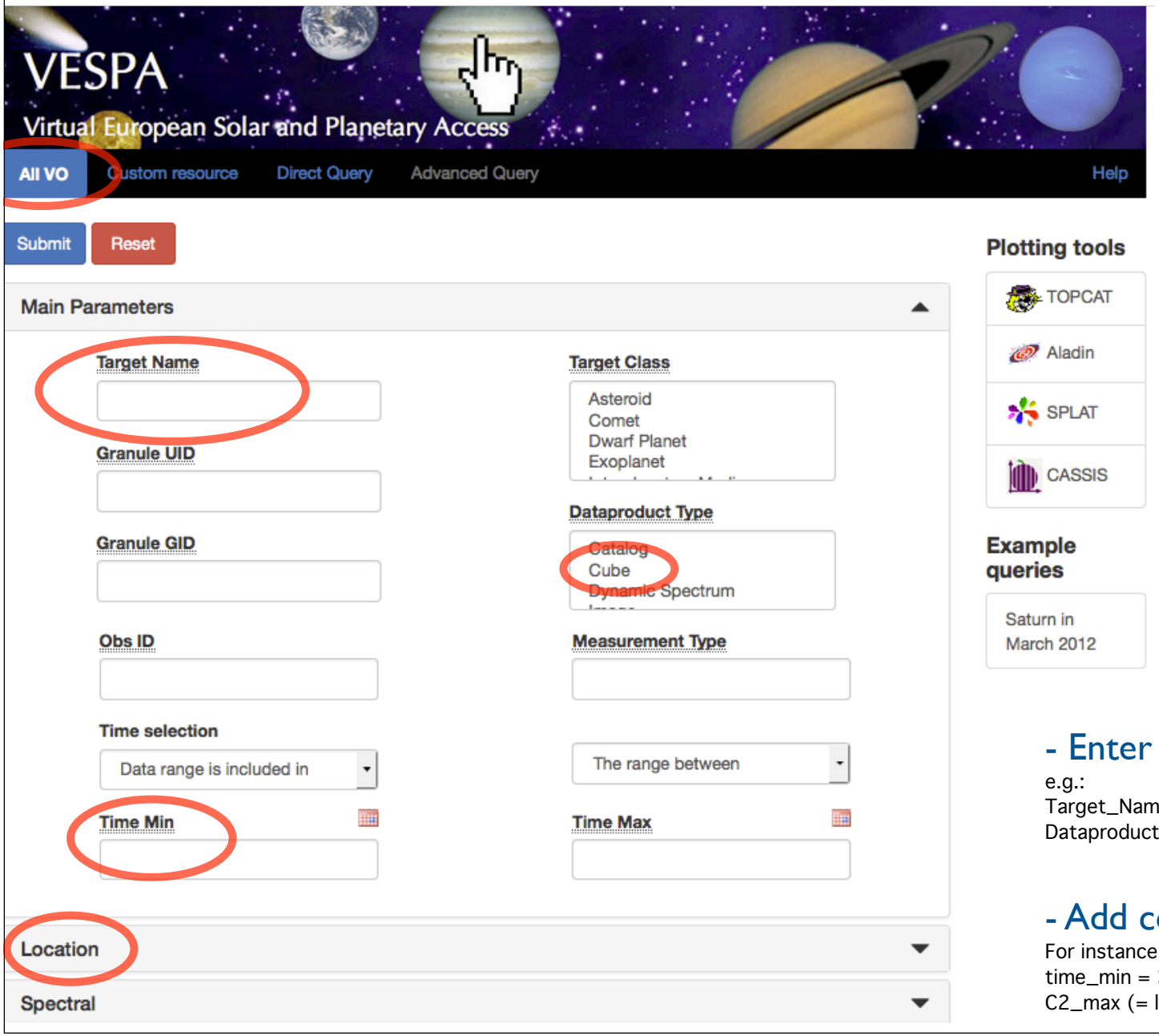
v1.4, 7/1/2017

Paris Astronomical Data Centre

Go to VESPA web site

http://vespa.obspm.fr



- Check "All VO" to access public data services

- Enter search parameters:

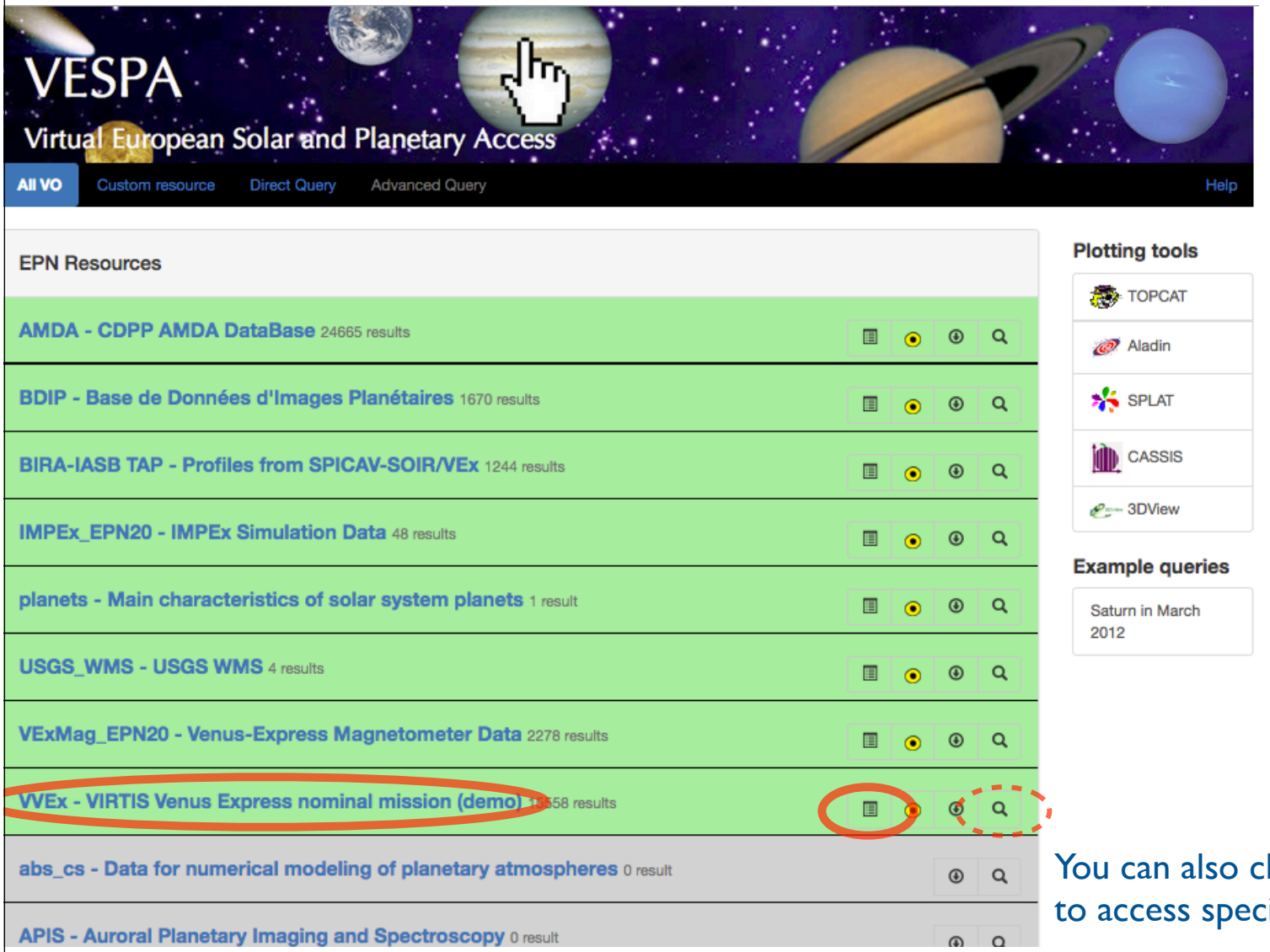
e.g.:
Target_Name = Venus
Dataproduct_type = cube

- Add constraints/filters

For instance:
time_min = 3/6/2006 & time_max = 28/8/2006
C2_max (= latitude) < 0 [in Location tab]

Service results

http://vespa.obspm.fr



- In line VVEx, 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 VVEx

Show 10 entries

Column visibility | Show all | Hide all

granule_uid	dataproduct_type	target_name	time_min (d)	time_max (d)	access_url	granule_gid	obs_id	target_
VI0025_02C	spectral_cube	Venus	2006-05-15T12:37:24.226	2006-05-15T12:47:06.250	VI0025_02.CAL	calibrated	VI0025_02	planet
VI0025_02G	spectral_cube	Venus	2006-05-15T12:37:24.226	2006-05-15T12:47:06.250	VI0025_02.GEO	geometry	VI0025_02	planet
VI0025_03G	spectral_cube	Venus	2006-05-15T12:52:56.287	2006-05-15T13:14:56.128	VI0025_03.GEO	geometry	VI0025_03	planet
VI0025_03C	spectral_cube	Venus	2006-05-15T12:52:56.287	2006-05-15T13:14:56.128	VI0025_03.CAL	calibrated	VI0025_03	planet
VI0025_04G	spectral_cube	Venus	2006-05-15T13:22:27.303	2006-05-15T13:44:22.329	VI0025_04.GEO	geometry	VI0025_04	planet
VI0025_04C	spectral_cube	Venus	2006-05-15T13:22:27.303	2006-05-15T13:44:22.329	VI0025_04.CAL	calibrated	VI0025_04	planet
VI0025_05C	spectral_cube	Venus	2006-05-15T13:51:56.362	2006-05-15T14:13:51.388	VI0025_05.CAL	calibrated	VI0025_05	planet
VI0025_05G	spectral_cube	Venus	2006-05-15T13:51:56.362	2006-05-15T14:13:51.388	VI0025_05.GEO	geometry	VI0025_05	planet
VI0025_06G	spectral_cube	Venus	2006-05-15T14:21:24.429	2006-05-15T14:32:06.108	VI0025_06.GEO	geometry	VI0025_06	planet
VI0025_06C	spectral_cube	Venus	2006-05-15T14:21:24.429	2006-05-15T14:32:06.108	VI0025_06.CAL	calibrated	VI0025_06	planet

Showing 11 to 20 of 15,682 entries

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Data Selection | Metadata Selection | All Data | All Metadata

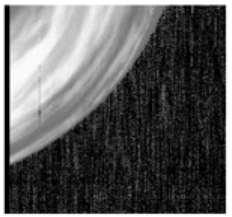
Earth | Footprints

Plotting tools

TOPCAT
Aladin
SPLAT
CASSIS
3DView

Example queries

Saturn in March 2012



- Click "Show all" to see other parameters

- Hover the mouse to see thumbnails

- Click to select one or more lines & click "Data selection" / Download to download files from the PSA

Displaying footprints

Results in service VVEx

Show 10 entries

Column visibility | Show all | Hide all

granule_uid	dataproduct_type	target_name	time_min (d)	time_max (d)	access_url
VV0025_05G	spectral_cube	Venus	2006-05-15T13:51:55.050	2006-05-15T14:13:50.075	VV0025_05.GEO
VV0025_05C	spectral_cube	Venus	2006-05-15T13:51:55.050	2006-05-15T14:13:50.075	VV0025_05.CAL
VI0025_05C	spectral_cube	Venus	2006-05-15T13:51:56.362	2006-05-15T14:13:51.388	VI0025_05.CAL
VI0025_05G	spectral_cube	Venus	2006-05-15T13:51:56.362	2006-05-15T14:13:51.388	VI0025_05.GEO
VI0025_06G	spectral_cube	Venus	2006-05-15T14:21:24.429	2006-05-15T14:32:06.108	VI0025_06.GEO
VI0025_06C	spectral_cube	Venus	2006-05-15T14:21:24.429	2006-05-15T14:32:06.108	VI0025_06.CAL
VV0025_06G	spectral_cube	Venus	2006-05-15T14:21:24.621	2006-05-15T14:32:06.302	VV0025_06.GEO
VV0025_06C	spectral_cube	Venus	2006-05-15T14:21:24.621	2006-05-15T14:32:06.302	VV0025_06.CAL
VI0025_07G	spectral_cube	Venus	2006-05-15T14:36:53.510	2006-05-15T14:47:37.464	VI0025_07.GEO
VI0025_07C	spectral_cube	Venus	2006-05-15T14:36:53.510	2006-05-15T14:47:37.464	VI0025_07.CAL

Showing 41 to 50 of 15,558 entries 1 row selected

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Data Selection | Metadata Selection | All Data | All Metadata | Venus | Footprints

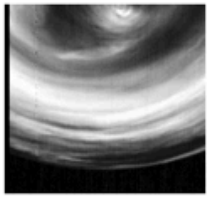
Send GeoJSON all
Send GeoJSON selection
Send s_region selection

Plotting tools

TOPCAT
Aladin
SPLAT
CASSIS
3DView

Example queries

Saturn in March 2012

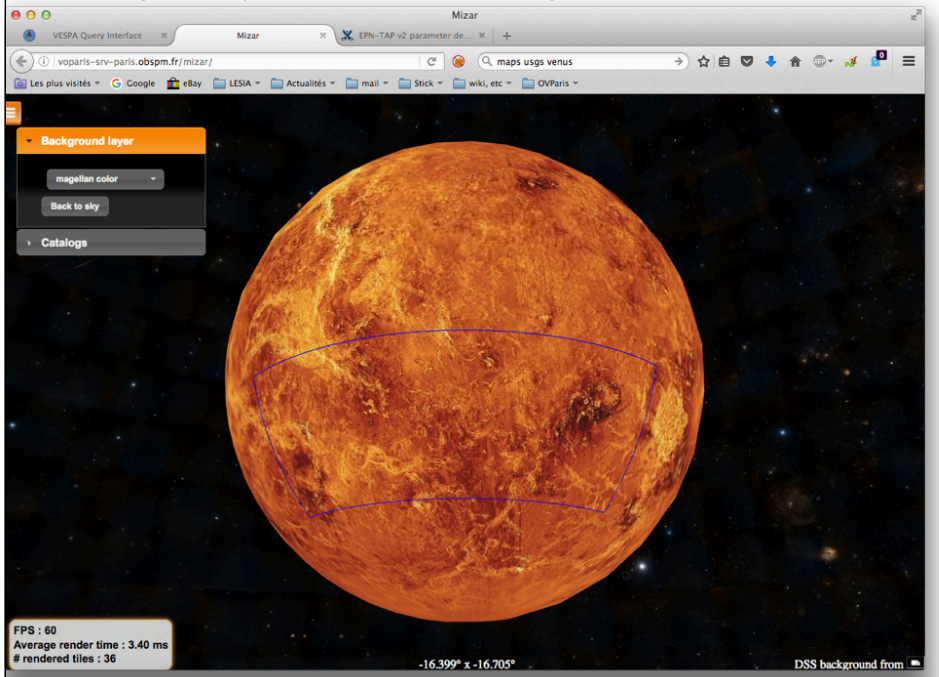


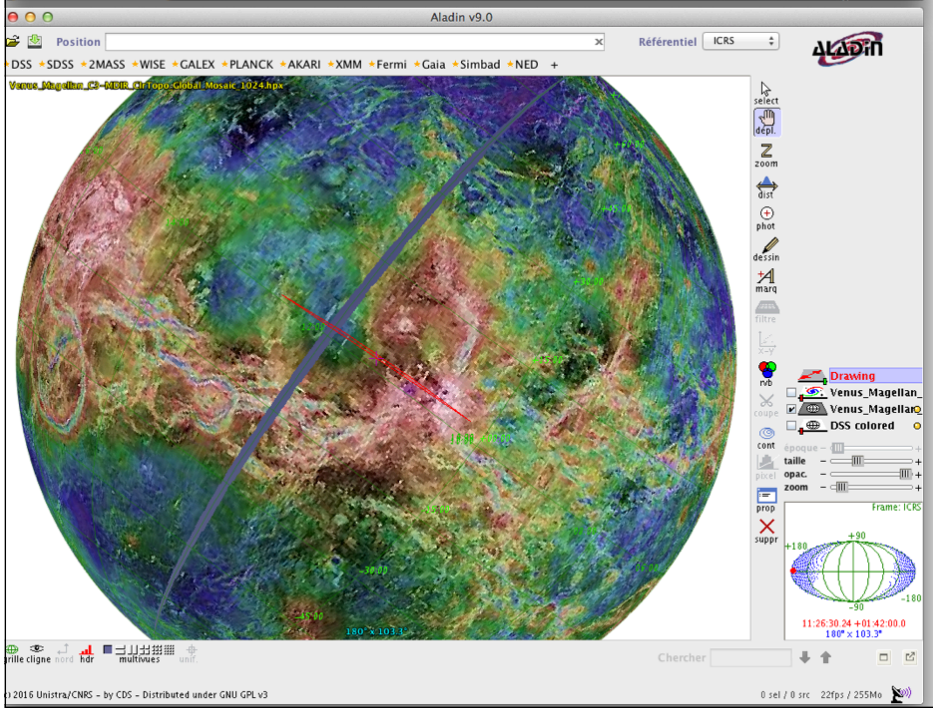
- Select correct target

- Click "Footprints" / Send GeoJSON to display bounding box in Mizar

- Click "Footprints" / Send s_region to display footprint in Aladin

Displaying footprints





- "GeoJSON" will open Mizar in a new browser tab and display the bounding box on a 3D sphere

- "s_region" will launch Aladin and display a more precise footprint on a 3D sphere, here as a red contour
(first load HIPS file of target manually to display background map)

In both cases you can rotate, zoom in/out, etc

Analysing results

Launch VO tools either from buttons or from your system

Results in service VVEx

Show 10 entries

Column visibility | Show all | Hide all

granule_uid	dataproduct_type	target_name	time_min (d)	time_max (d)	access_url	granule_gid	obs_id	target_
VI0025_02C	spectral_cube	Venus	2006-05-15T12:37:24.226	2006-05-15T12:47:06.250	VI0025_02.CAL	calibrated	VI0025_02	planet
VI0025_02G	spectral_cube	Venus	2006-05-15T12:37:24.226	2006-05-15T12:47:06.250	VI0025_02.GEO	geometry	VI0025_02	planet
VI0025_03G	spectral_cube	Venus	2006-05-15T12:52:56.287	2006-05-15T13:14:56.128	VI0025_03.GEO	geometry	VI0025_03	planet
VI0025_03C	spectral_cube	Venus	2006-05-15T12:52:56.287	2006-05-15T13:14:56.128	VI0025_03.CAL	calibrated	VI0025_03	planet
VI0025_04G	spectral_cube	Venus	2006-05-15T13:22:27.303	2006-05-15T13:44:22.329	VI0025_04.GEO	geometry	VI0025_04	planet
VI0025_04C	spectral_cube	Venus	2006-05-15T13:22:27.303	2006-05-15T13:44:22.329	VI0025_04.CAL	calibrated	VI0025_04	planet
VI0025_05C	spectral_cube	Venus	2006-05-15T13:51:56.362	2006-05-15T14:13:51.388	VI0025_05.CAL	calibrated	VI0025_05	planet
VI0025_05G	spectral_cube	Venus	2006-05-15T13:51:56.362	2006-05-15T14:13:51.388	VI0025_05.GEO	geometry	VI0025_05	planet
VI0025_06G	spectral_cube	Venus	2006-05-15T14:21:24.429	2006-05-15T14:32:06.108	VI0025_06.GEO	geometry	VI0025_06	planet
VI0025_06C	spectral_cube	Venus	2006-05-15T14:21:24.429	2006-05-15T14:32:06.108	VI0025_06.CAL	calibrated	VI0025_06	planet

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Data Selection | Metadata Selection | All Data | All Metadata | Earth | Footprints

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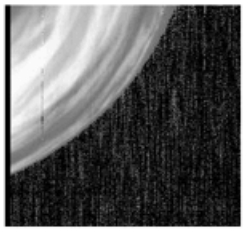
Plotting tools

- 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

Analysing dataset

Click "All Metadata" / Send Table

=> TOPCAT will receive a description of all files

Results in service VVEx

Show 10 entries

Column visibility | Show all | Hide all

granule_uid	dataproduct_type	target_name	time_min (d)	time_max (d)	access_url	granule_gid	obs_id	target_
VI0025_02C	spectral_cube	Venus	2006-05-15T12:37:24.226	2006-05-15T12:47:06.250	VI0025_02.CAL	calibrated	VI0025_02	planet
VI0025_02G	spectral_cube	Venus	2006-05-15T12:37:24.226	2006-05-15T12:47:06.250	VI0025_02.GEO	geometry	VI0025_02	planet
VI0025_03G	spectral_cube	Venus	2006-05-15T12:52:56.287	2006-05-15T13:14:56.128	VI0025_03.GEO	geometry	VI0025_03	planet
VI0025_03C	spectral_cube	Venus	2006-05-15T12:52:56.287	2006-05-15T13:14:56.128	VI0025_03.CAL	calibrated	VI0025_03	planet
VI0025_04G	spectral_cube	Venus	2006-05-15T13:22:27.303	2006-05-15T13:44:22.329	VI0025_04.GEO	geometry	VI0025_04	planet
VI0025_04C	spectral_cube	Venus	2006-05-15T13:22:27.303	2006-05-15T13:44:22.329	VI0025_04.CAL	calibrated	VI0025_04	planet
VI0025_05C	spectral_cube	Venus	2006-05-15T13:51:56.362	2006-05-15T14:13:51.388	VI0025_05.CAL	calibrated	VI0025_05	planet
VI0025_05G	spectral_cube	Venus	2006-05-15T13:51:56.362	2006-05-15T14:13:51.388	VI0025_05.GEO	geometry	VI0025_05	planet
VI0025_06G	spectral_cube	Venus	2006-05-15T14:21:24.429	2006-05-15T14:32:06.108	VI0025_06.GEO	geometry	VI0025_06	planet
VI0025_06C	spectral_cube	Venus	2006-05-15T14:21:24.429	2006-05-15T14:32:06.108	VI0025_06.CAL	calibrated	VI0025_06	planet

Showing 11 to 20 of 15,682 entries

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Data Selection | Metadata Selection | All Data | All Metadata

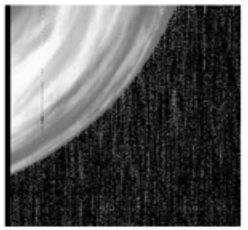
Earth | Footprints

Plotting tools

TOPCAT | Aladin | SPLAT | CASSIS | 3DView

Example queries

Saturn in March 2012



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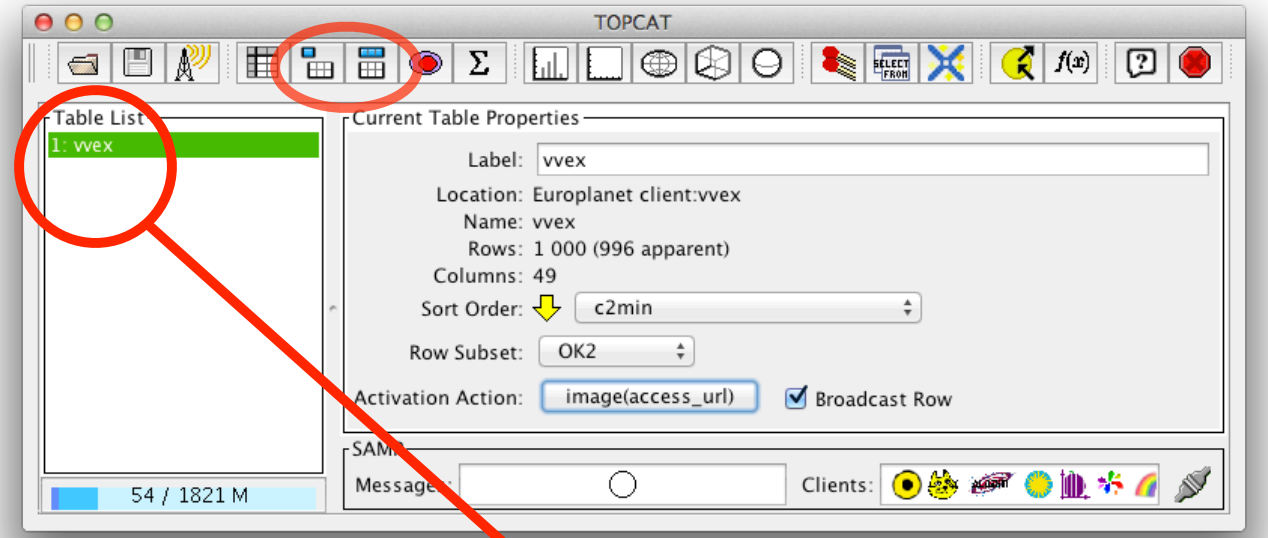
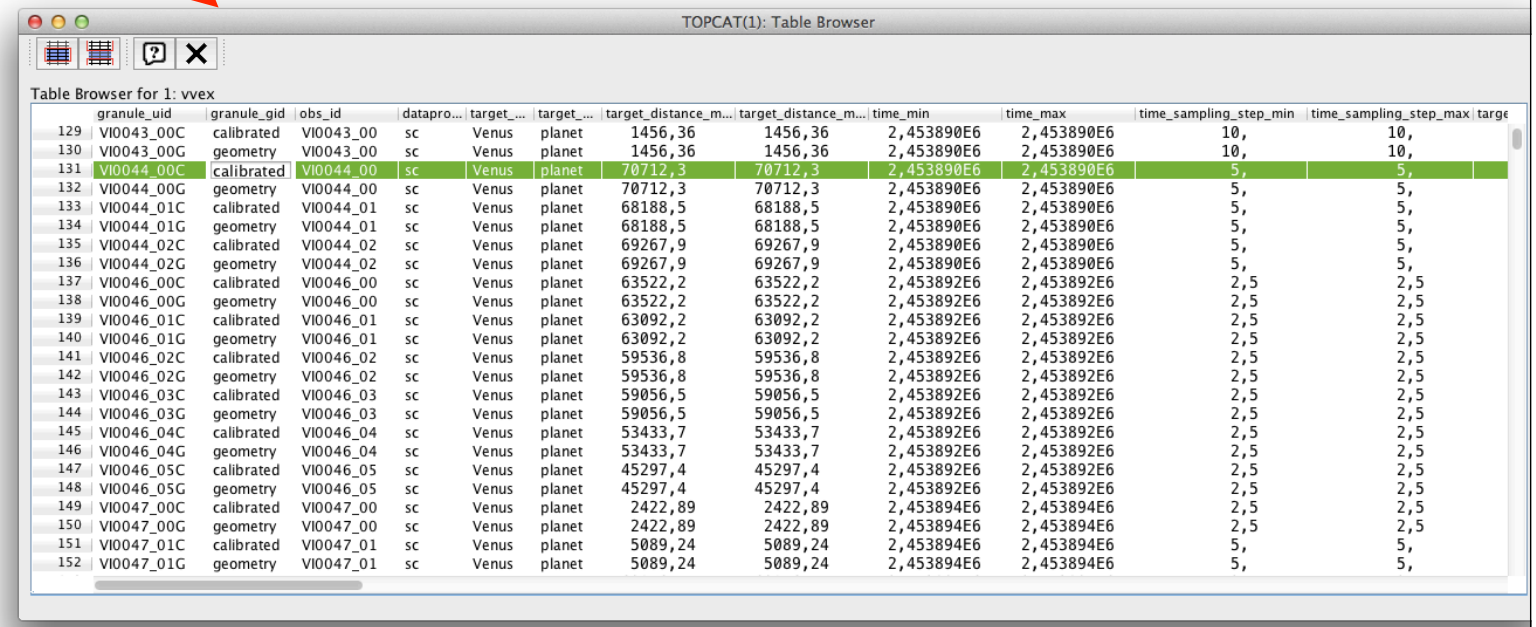
You can also select some lines & click "Metadata selection"

Analysing dataset

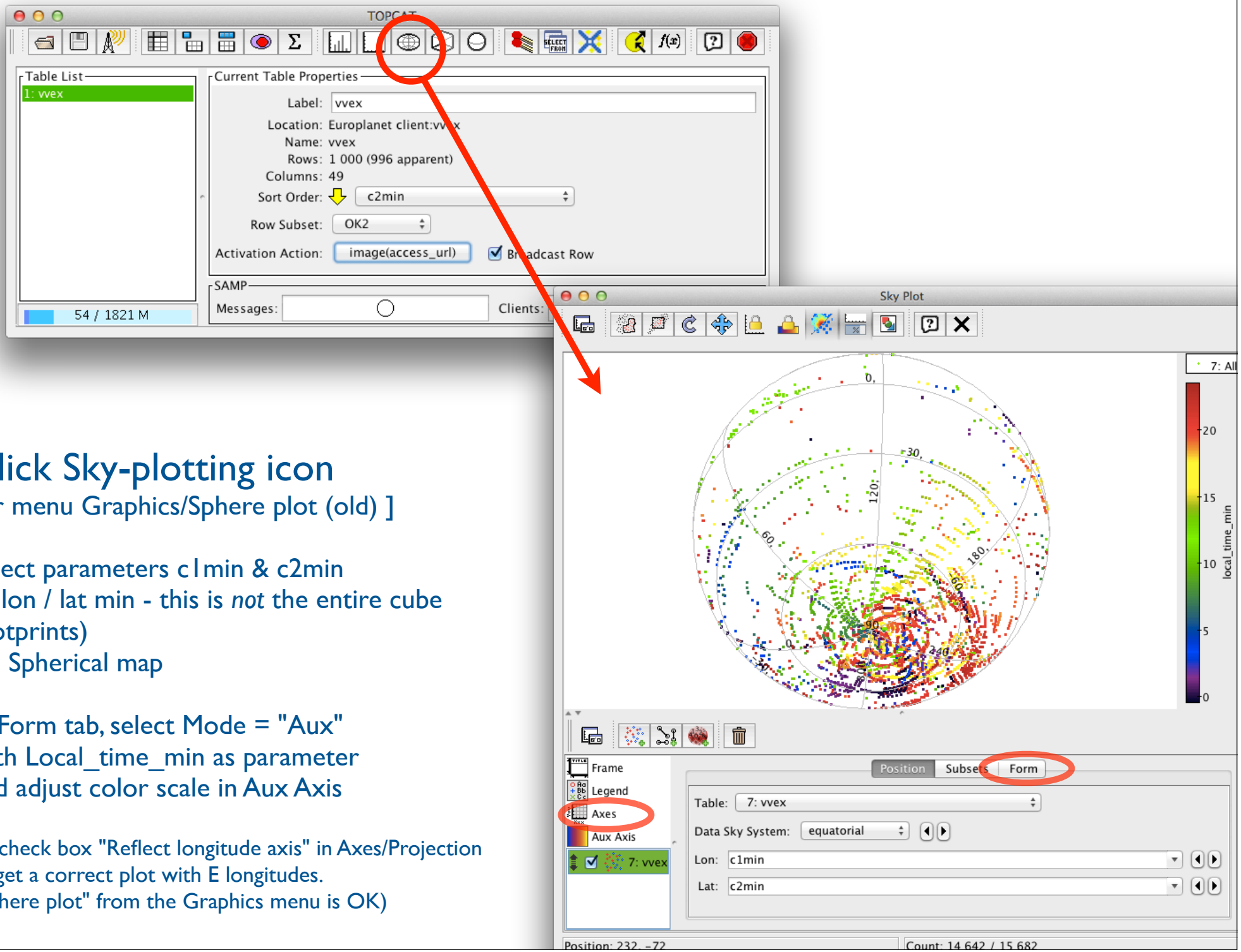




	granule_uid	granule_gid	obs_id	datapro...	target_...	target_...	target_distance_m...	target_distance_m...	time_min	time_max	time_sampling_step_min	time_sampling_step_max	targe
129	VI0043_00C	calibrated	VI0043_00	sc	Venus	planet	1456,36	1456,36	2,453890E6	2,453890E6	10,	10,	
130	VI0043_00G	geometry	VI0043_00	sc	Venus	planet	1456,36	1456,36	2,453890E6	2,453890E6	10,	10,	
131	VI0044_00C	calibrated	VI0044_00	sc	Venus	planet	70712,3	70712,3	2,453890E6	2,453890E6	5,	5,	
132	VI0044_00G	geometry	VI0044_00	sc	Venus	planet	70712,3	70712,3	2,453890E6	2,453890E6	5,	5,	
133	VI0044_01C	calibrated	VI0044_01	sc	Venus	planet	68188,5	68188,5	2,453890E6	2,453890E6	5,	5,	
134	VI0044_01G	geometry	VI0044_01	sc	Venus	planet	68188,5	68188,5	2,453890E6	2,453890E6	5,	5,	
135	VI0044_02C	calibrated	VI0044_02	sc	Venus	planet	69267,9	69267,9	2,453890E6	2,453890E6	5,	5,	
136	VI0044_02G	geometry	VI0044_02	sc	Venus	planet	69267,9	69267,9	2,453890E6	2,453890E6	5,	5,	
137	VI0046_00C	calibrated	VI0046_00	sc	Venus	planet	63522,2	63522,2	2,453892E6	2,453892E6	2,5	2,5	
138	VI0046_00G	geometry	VI0046_00	sc	Venus	planet	63522,2	63522,2	2,453892E6	2,453892E6	2,5	2,5	
139	VI0046_01C	calibrated	VI0046_01	sc	Venus	planet	63092,2	63092,2	2,453892E6	2,453892E6	2,5	2,5	
140	VI0046_01G	geometry	VI0046_01	sc	Venus	planet	63092,2	63092,2	2,453892E6	2,453892E6	2,5	2,5	
141	VI0046_02C	calibrated	VI0046_02	sc	Venus	planet	59536,8	59536,8	2,453892E6	2,453892E6	2,5	2,5	
142	VI0046_02G	geometry	VI0046_02	sc	Venus	planet	59536,8	59536,8	2,453892E6	2,453892E6	2,5	2,5	
143	VI0046_03C	calibrated	VI0046_03	sc	Venus	planet	59056,5	59056,5	2,453892E6	2,453892E6	2,5	2,5	
144	VI0046_03G	geometry	VI0046_03	sc	Venus	planet	59056,5	59056,5	2,453892E6	2,453892E6	2,5	2,5	
145	VI0046_04C	calibrated	VI0046_04	sc	Venus	planet	53433,7	53433,7	2,453892E6	2,453892E6	2,5	2,5	
146	VI0046_04G	geometry	VI0046_04	sc	Venus	planet	53433,7	53433,7	2,453892E6	2,453892E6	2,5	2,5	
147	VI0046_05C	calibrated	VI0046_05	sc	Venus	planet	45297,4	45297,4	2,453892E6	2,453892E6	2,5	2,5	
148	VI0046_05G	geometry	VI0046_05	sc	Venus	planet	45297,4	45297,4	2,453892E6	2,453892E6	2,5	2,5	
149	VI0047_00C	calibrated	VI0047_00	sc	Venus	planet	2422,89	2422,89	2,453894E6	2,453894E6	2,5	2,5	
150	VI0047_00G	geometry	VI0047_00	sc	Venus	planet	2422,89	2422,89	2,453894E6	2,453894E6	2,5	2,5	
151	VI0047_01C	calibrated	VI0047_01	sc	Venus	planet	5089,24	5089,24	2,453894E6	2,453894E6	5,	5,	
152	VI0047_01G	geometry	VI0047_01	sc	Venus	planet	5089,24	5089,24	2,453894E6	2,453894E6	5,	5,	

In TOPCAT, double-click table name to open it

Click menu buttons to get description of fields



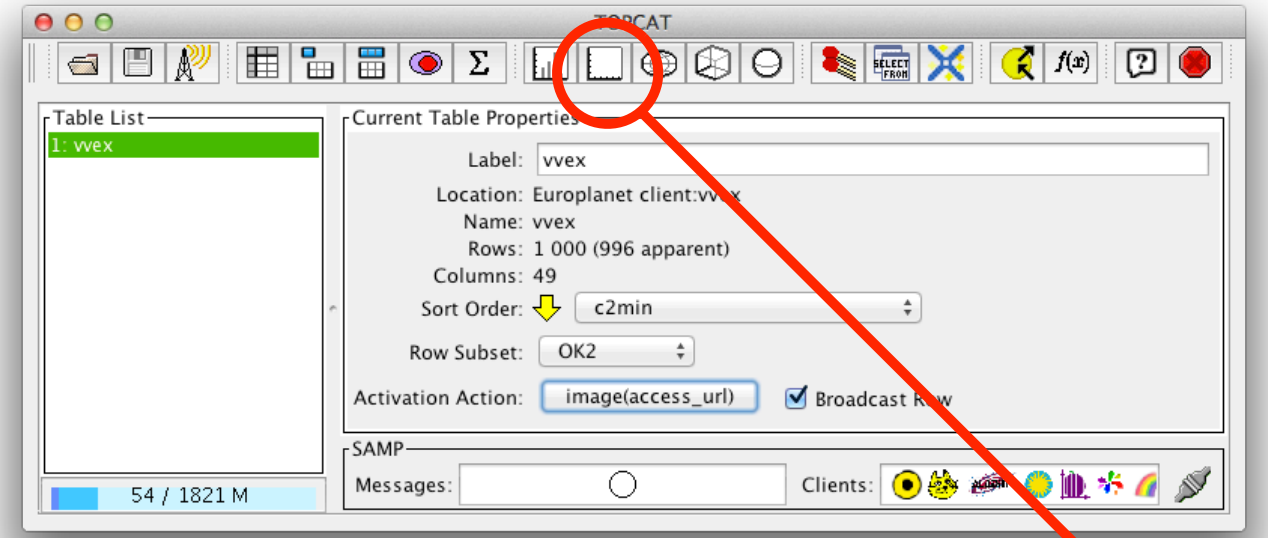
Click Sky-plotting icon

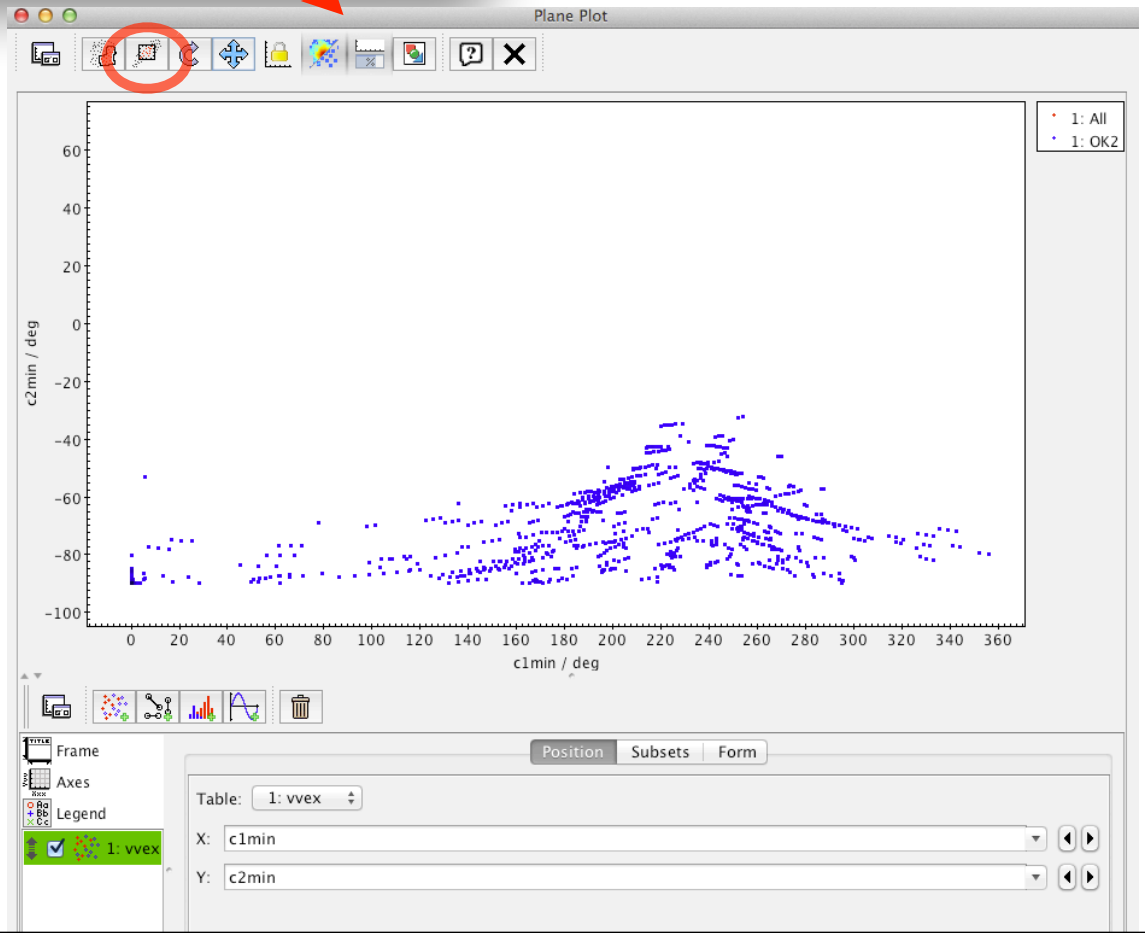
[or menu Graphics/Sphere plot (old)]

Select parameters c1min & c2min
(= lon / lat min - this is *not* the entire cube footprints)
=> Spherical map

In Form tab, select Mode = "Aux"
with Local_time_min as parameter
and adjust color scale in Aux Axis

(uncheck box "Reflect longitude axis" in Axes/Projection to get a correct plot with E longitudes.
"Sphere plot" from the Graphics menu is OK)

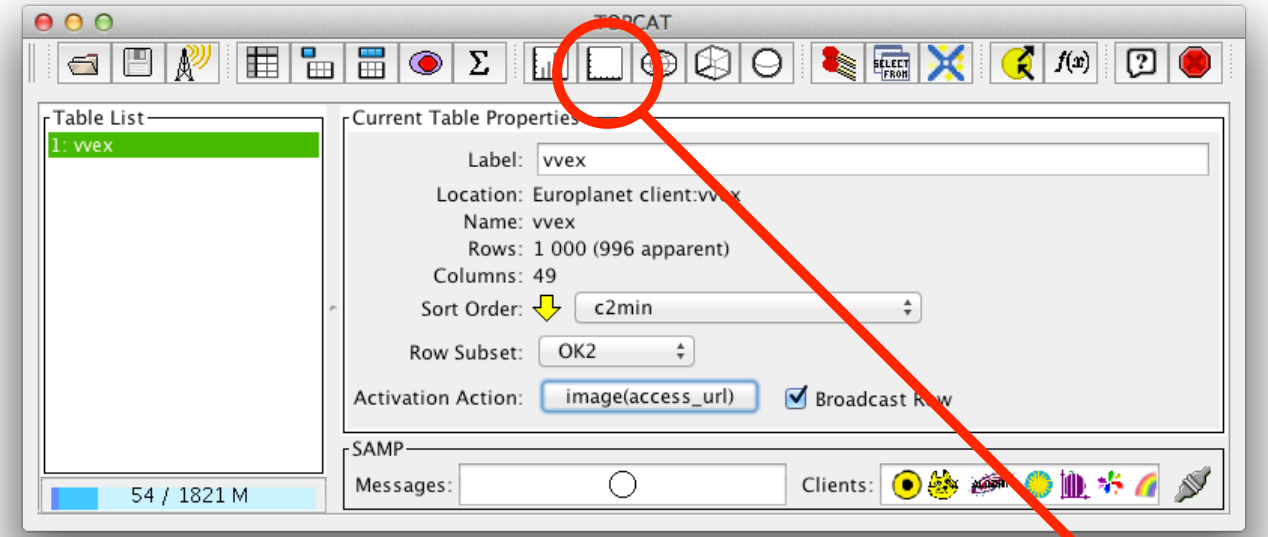


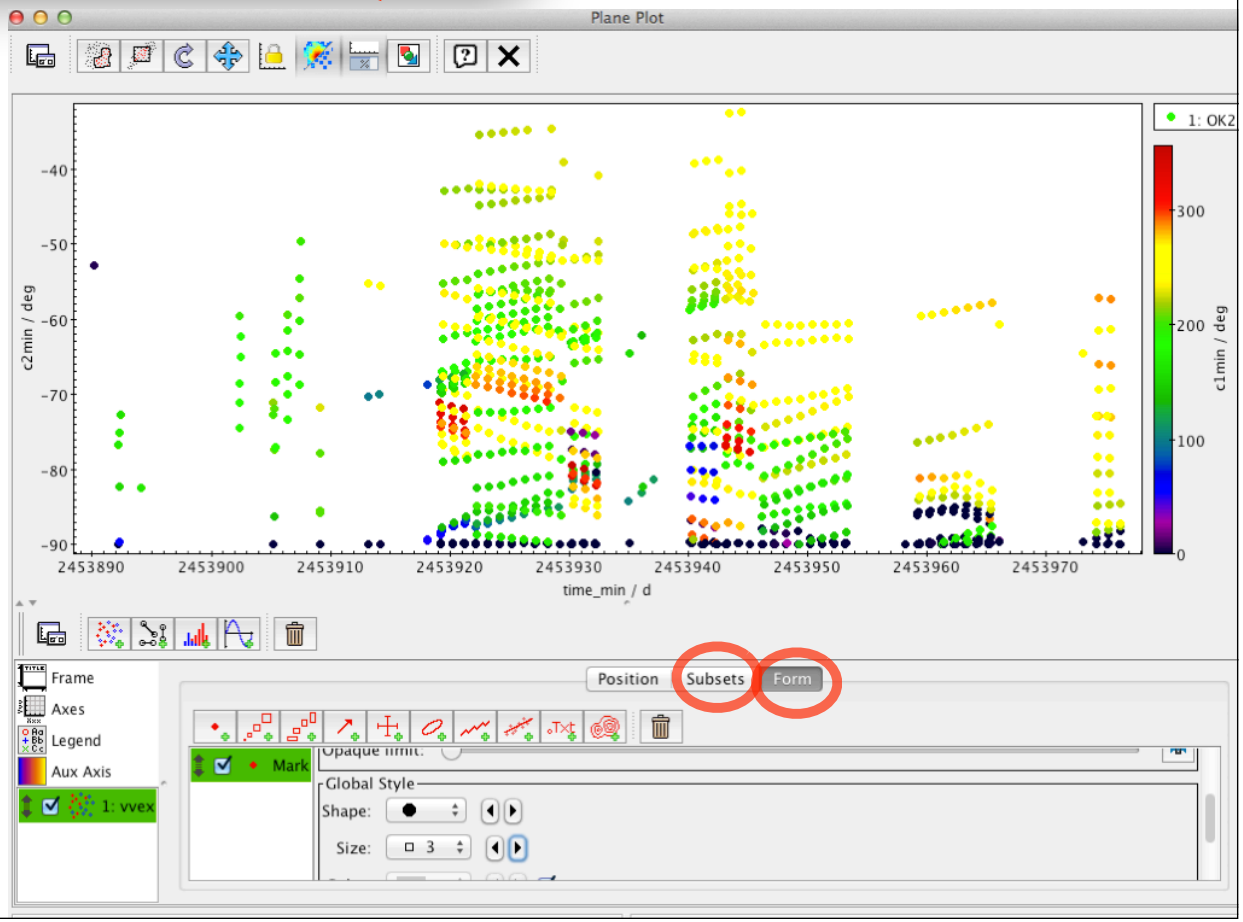


Click plane-plotting icon

Select parameters C1min & C2min
=> Cylindrical map

Some values are out of bound
Select region of correct points
(0/360° and -90/90°) with shift-drag and
click "Define subset"
Call it "OK2"





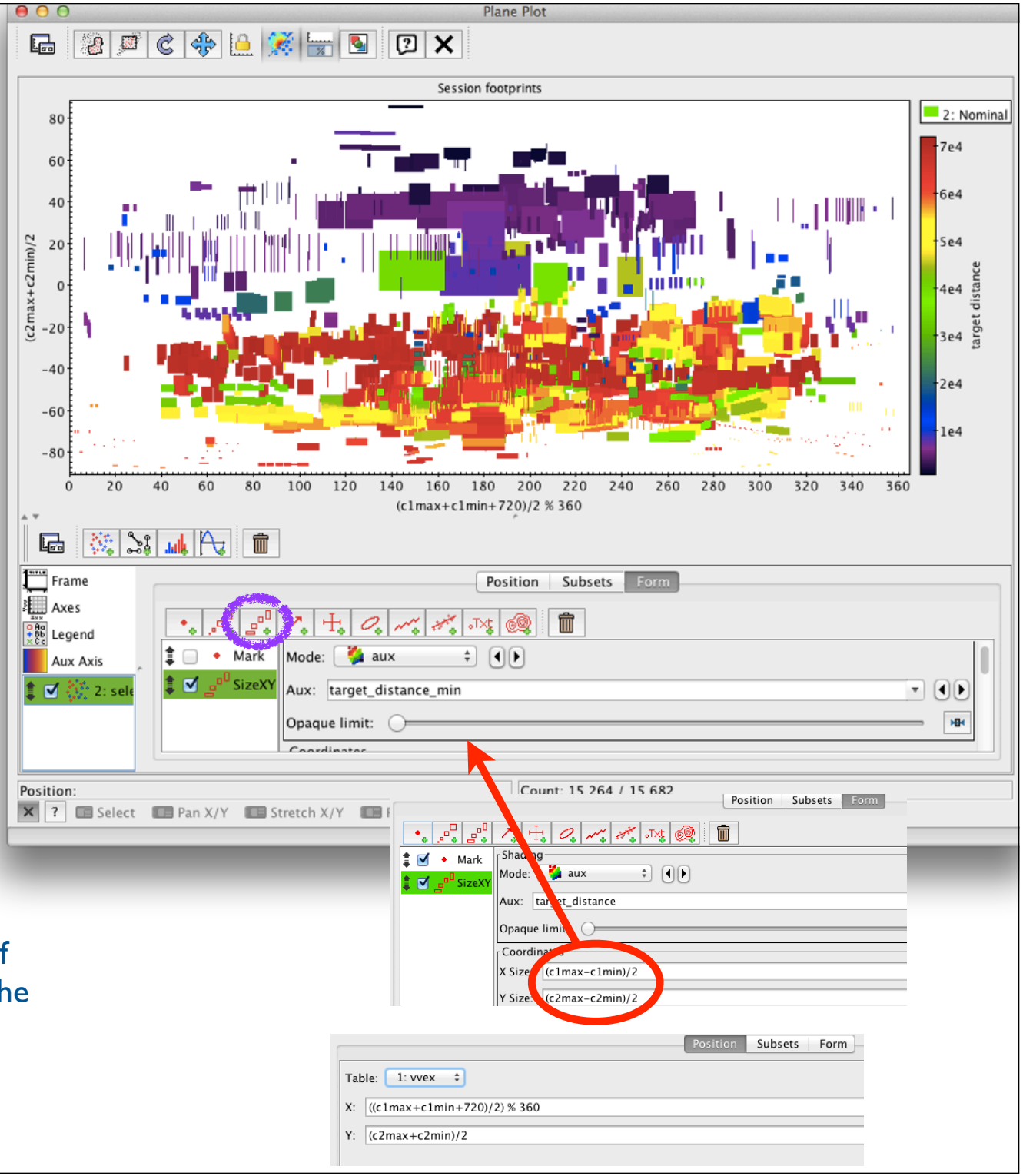
Click plane-plotting icon

Select parameters time_min & C2min
Select "OK2" in Subsets tab
Select Mode=Aux & "C1min" in Form tab
=> Coverage through time

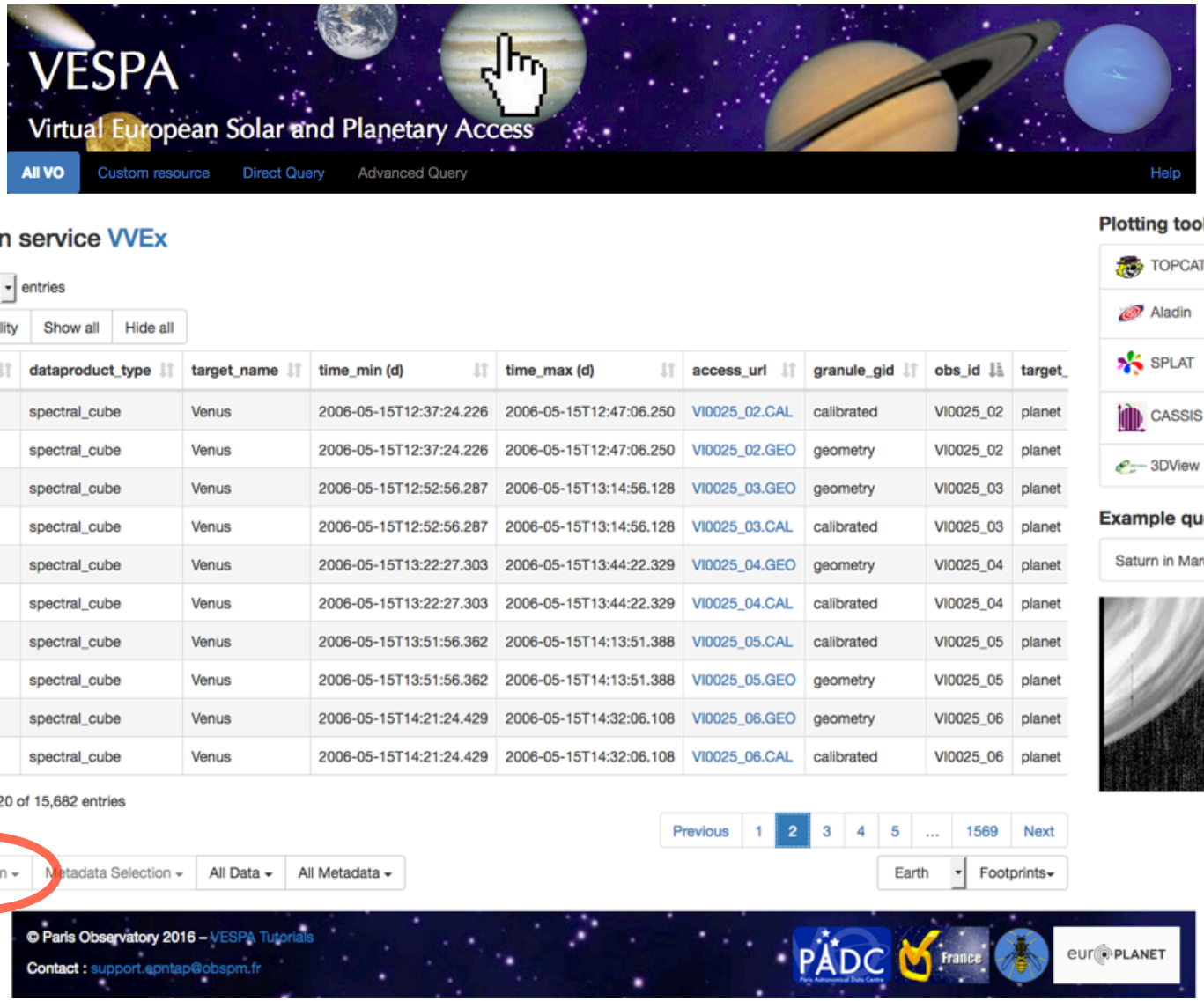
Clicking a point in any plot enlights it in other plots and tables => you can easily track outliers

In plane plot, click SizeXY option

In c1min vs c2min plot, define coordinates and sizes as in example. This provides a rough approximation of the footprints in cylindral projection (the actual footprints are inside the boxes)



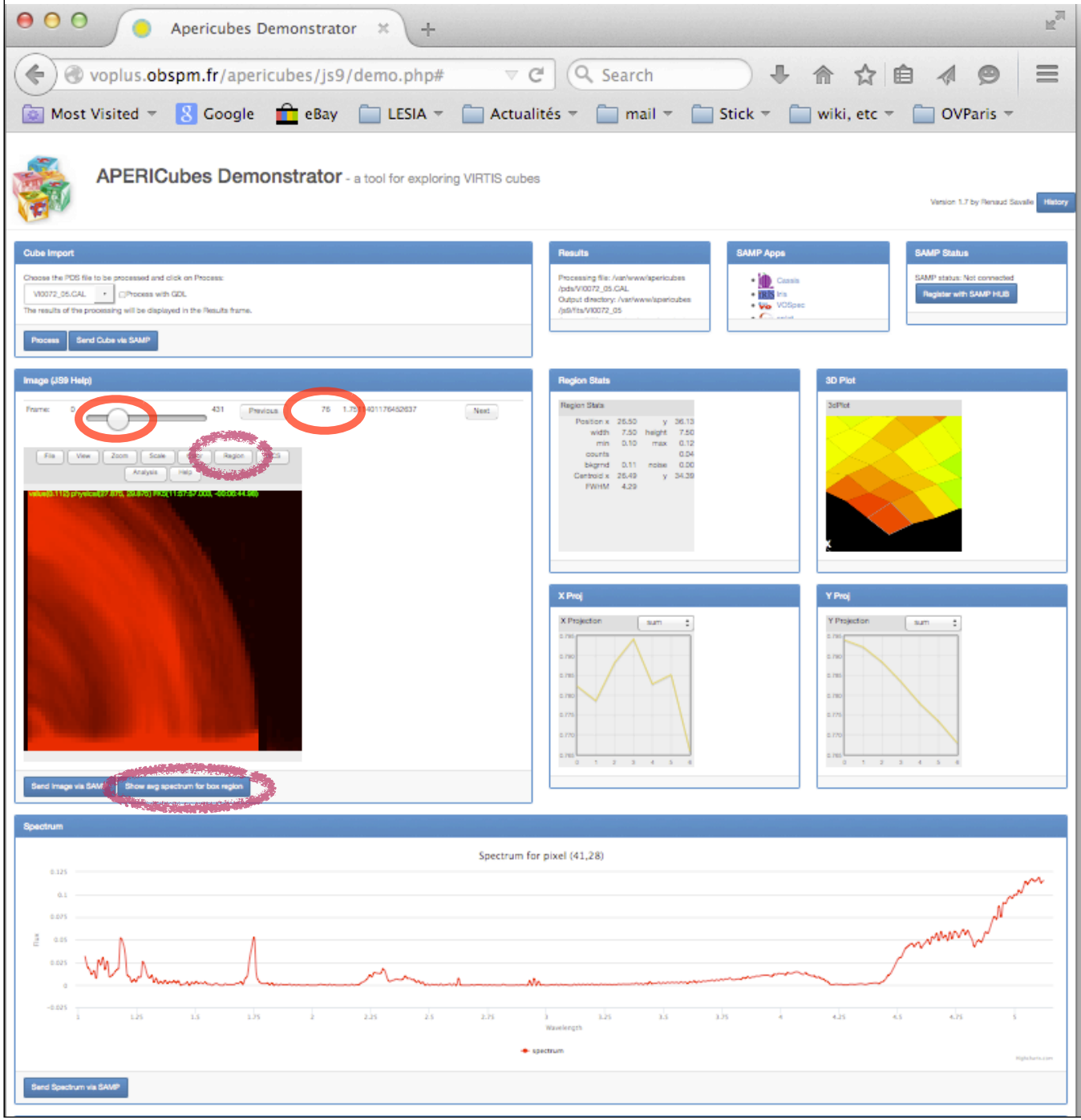
Analysing cubes



Select one line & click "Data Selection" / Send VIRTIS PDS cubes (use a VIRTIS-M cube, with name starting in VI or VV)

=> will send a cube to APERICubes

Visualization of spectral cubes



http://voplus.obspm.fr/apericubes/js9/demo.php

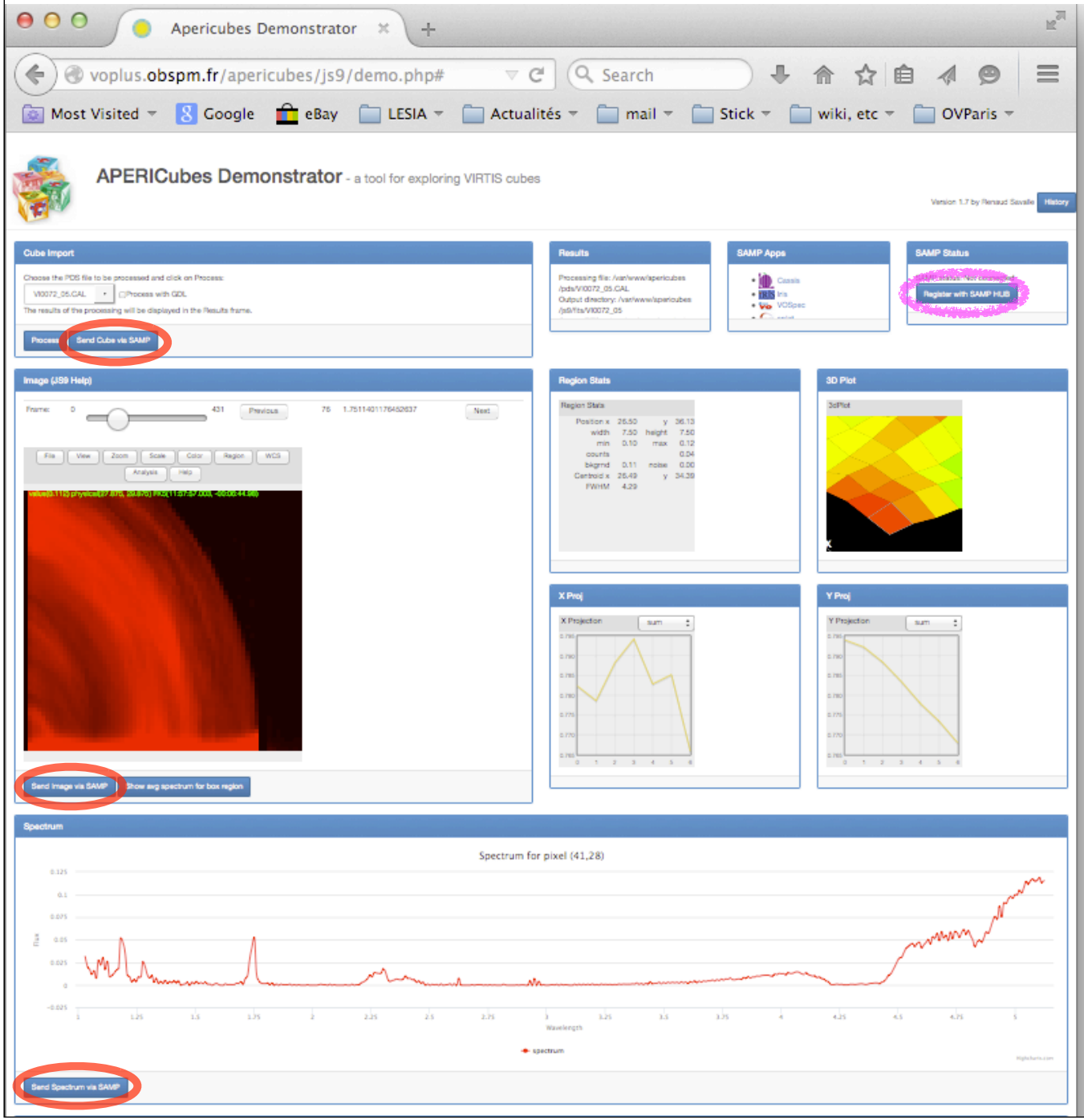
Validate all dialogues
(and wait a bit)
Will open a new tab in your browser

Select channel 75
(O_2 emission on night side)
Adjust contrast by clicking & dragging mouse over image

Click location in image
corresponding spectrum will plot below

You can also select a box region and move it on the image => average spectrum and box statistics

Visualization of spectral cubes



http://voplus.obspm.fr/apericubes/js9/demo.php

(with VOtools launched)

Check Samp status

(if not connected click "Register with SAMP HUB")

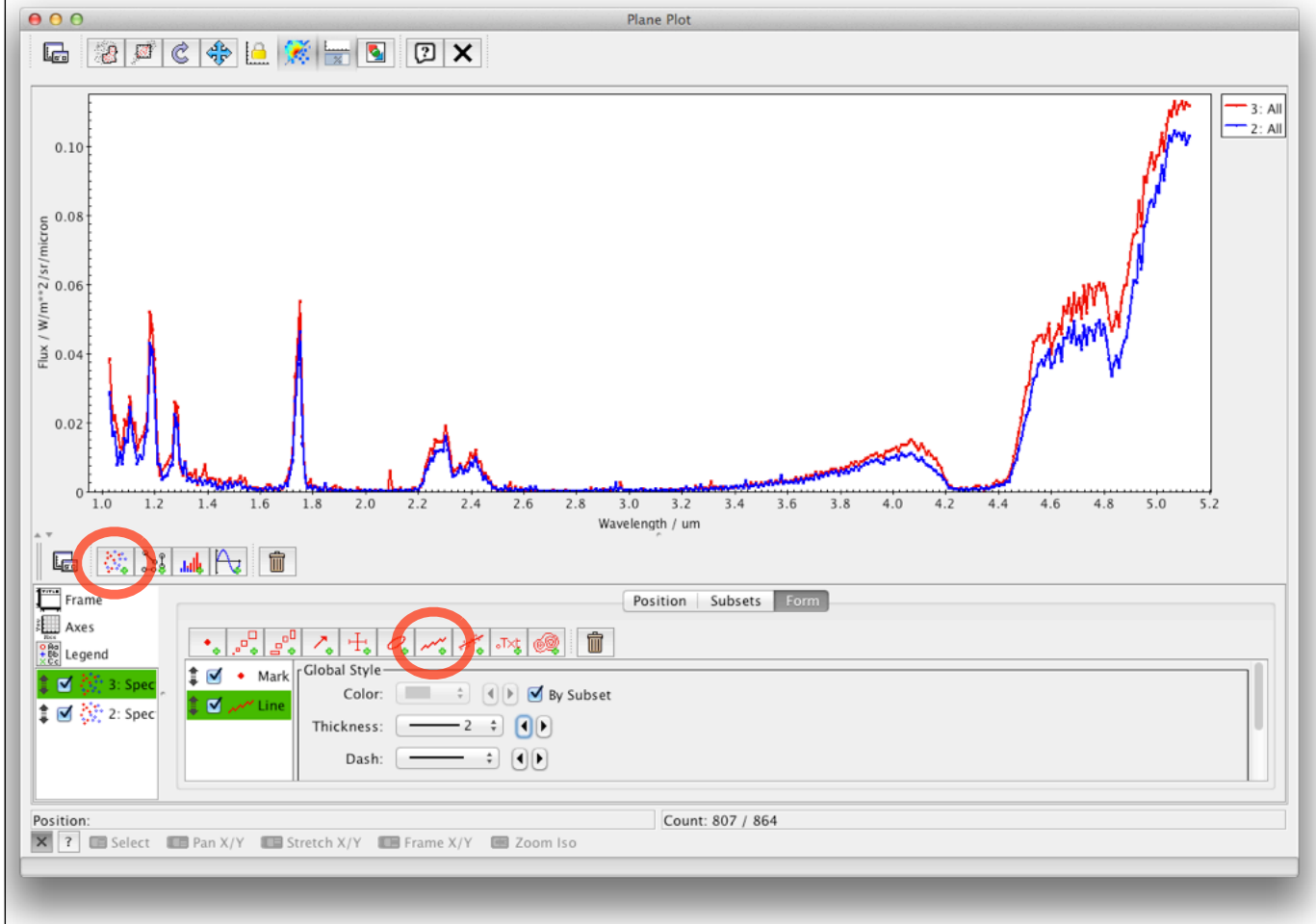
Click on a "Send… via SAMP" button

Images and cubes will display in Aladin

Spectra will display in TOPCAT, CASSIS, VOspec, Specview, etc

(PDS3 data have been read & converted to FITS files in a local IDL or GDL session)

Spectral tools: TOPCAT



TOPCAT receives spectra from APERICubes, can overplot selections

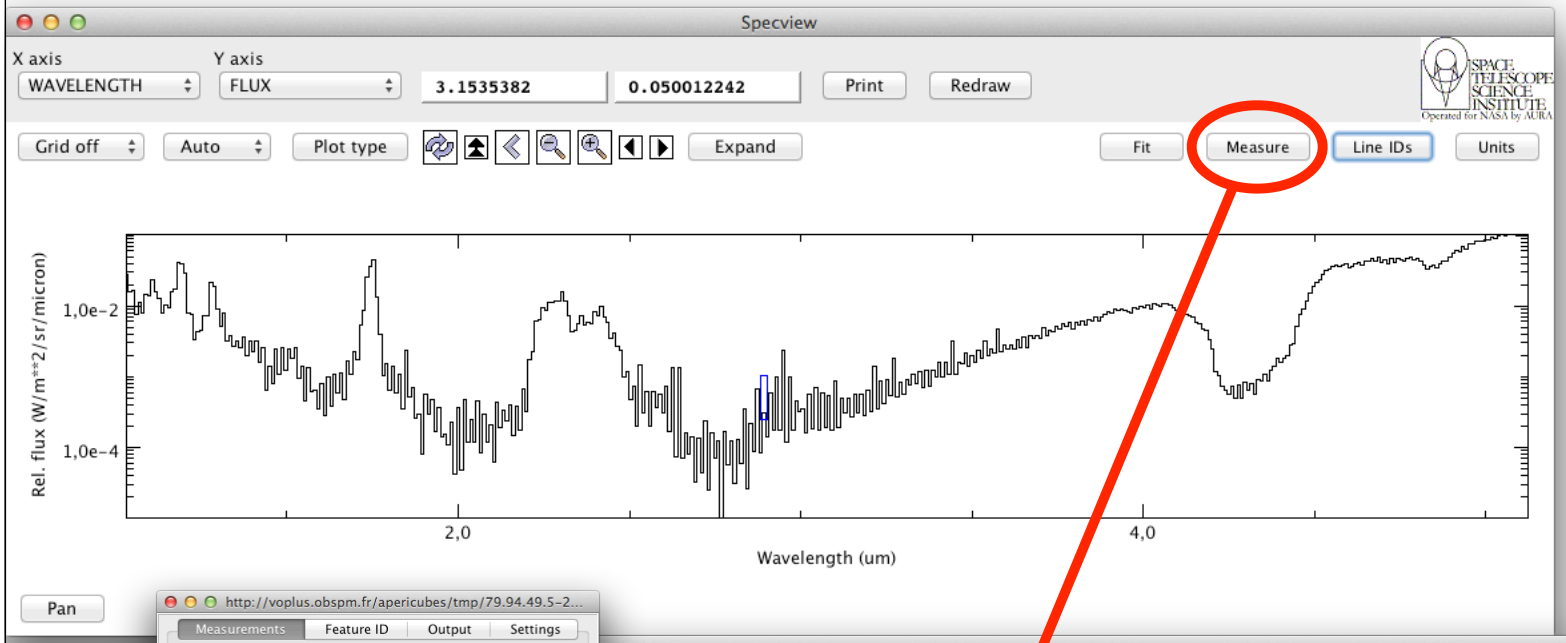
Use "Plane plot" & check parameters

Click "New line form" to connect spectral channels

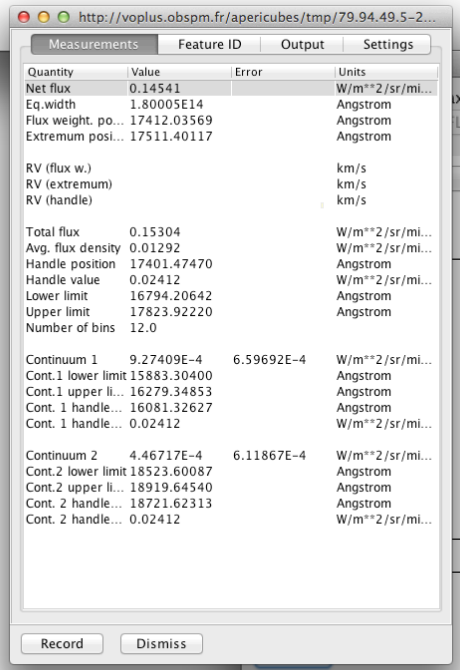
Click "Add new plot" to overplot spectra

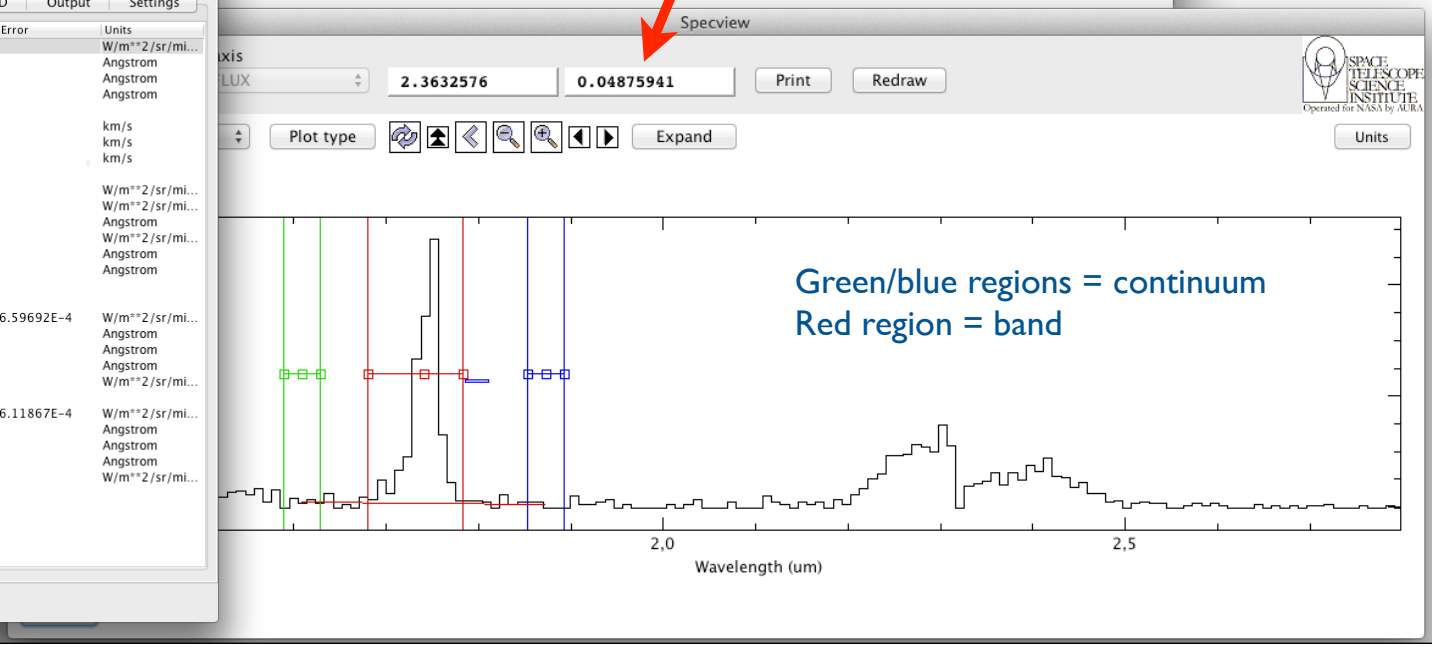
Spectral tools: Specview

Specview receives spectra from APERICubes
Includes analysis functions

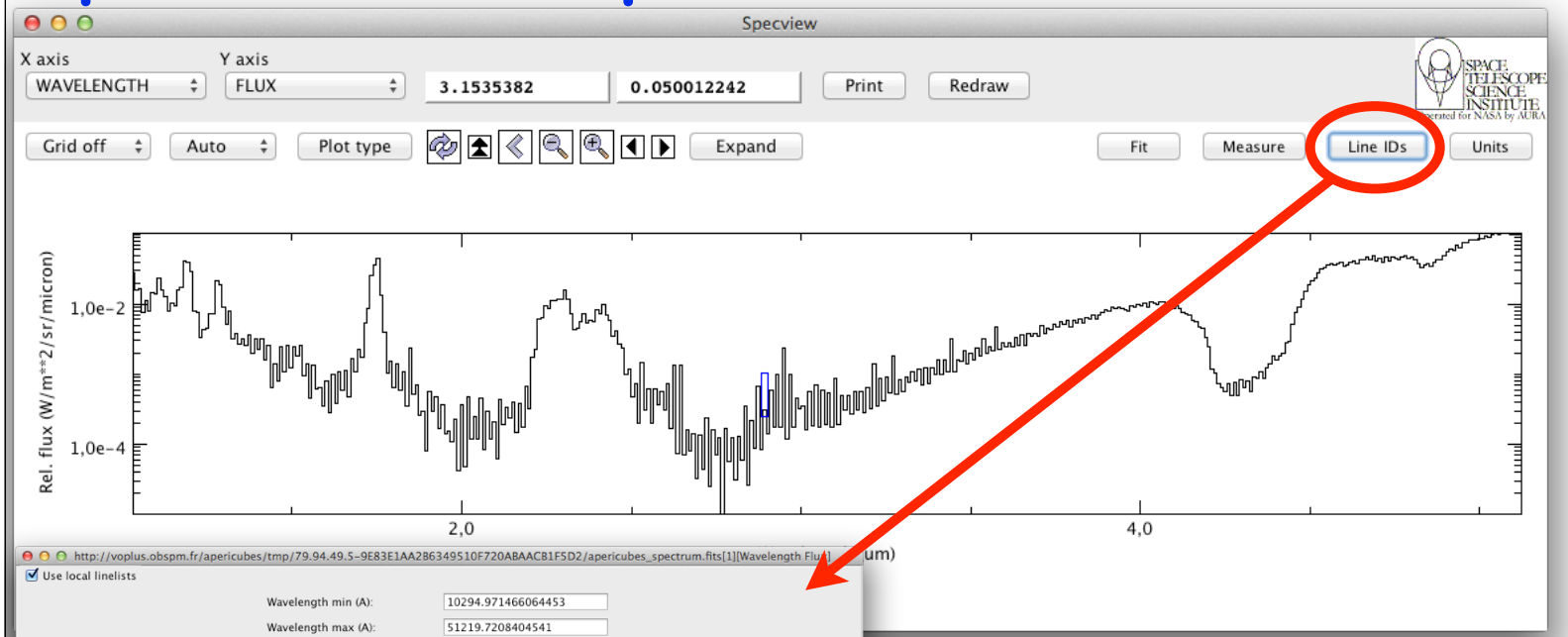


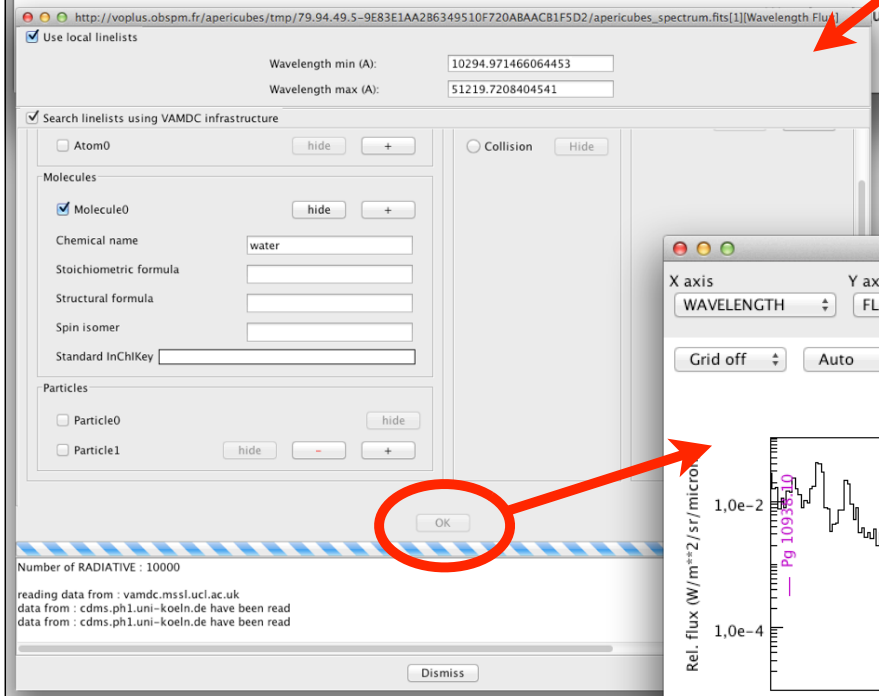
Click on "Measure" to perform continuum and band measurements

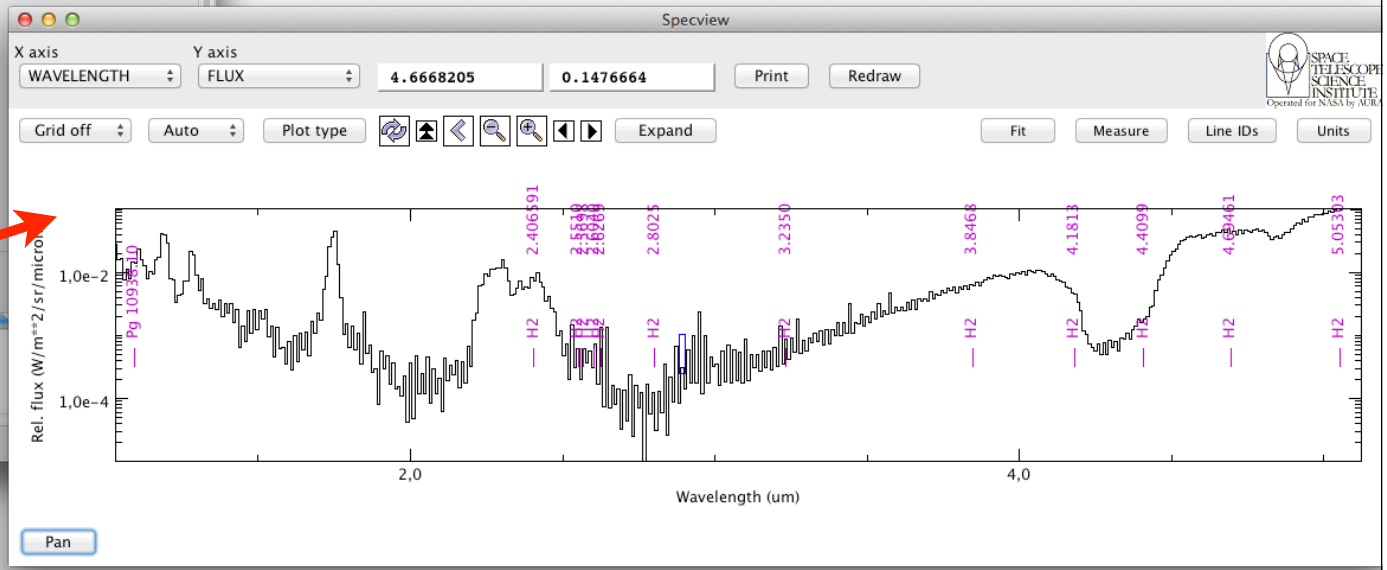




Spectral tools: Specview



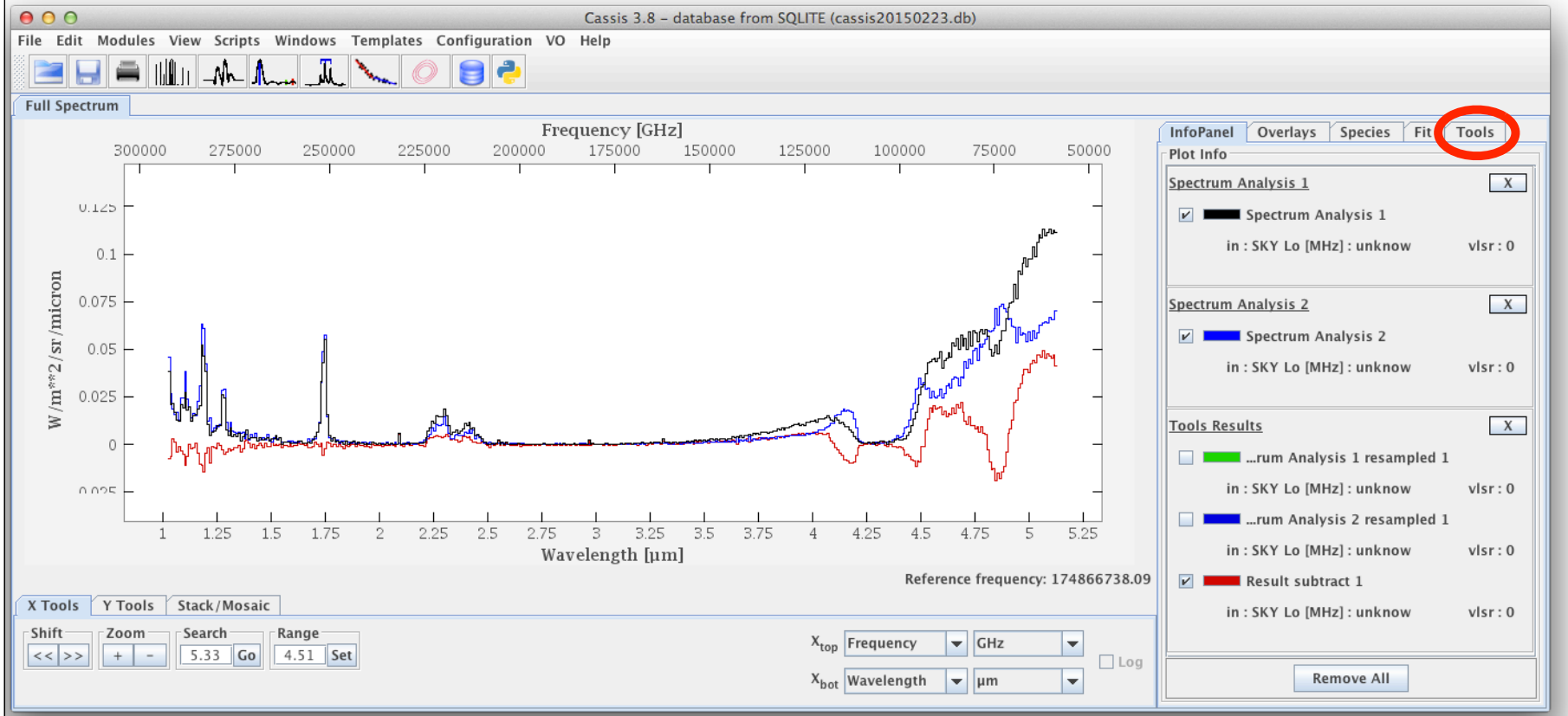




Click on "Line IDs" to query band line databases (from VAMDC) - pick up relevant ones

Spectral tools: *CASSIS*

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

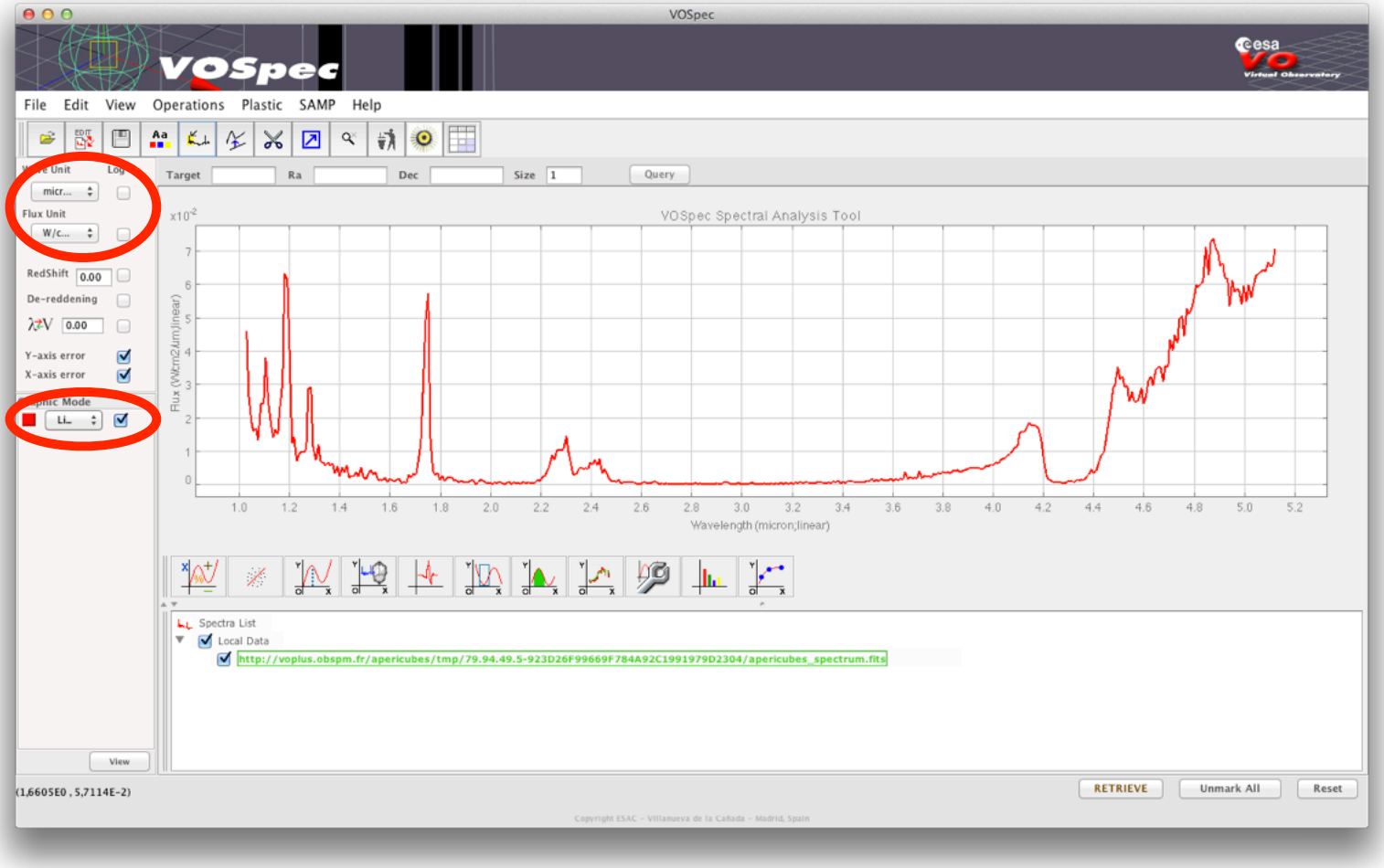


Press "shift" to get info on mouse location
"Alt"-drag to select a region (used in "Fit" tab)
"Alt"-click to put markers

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

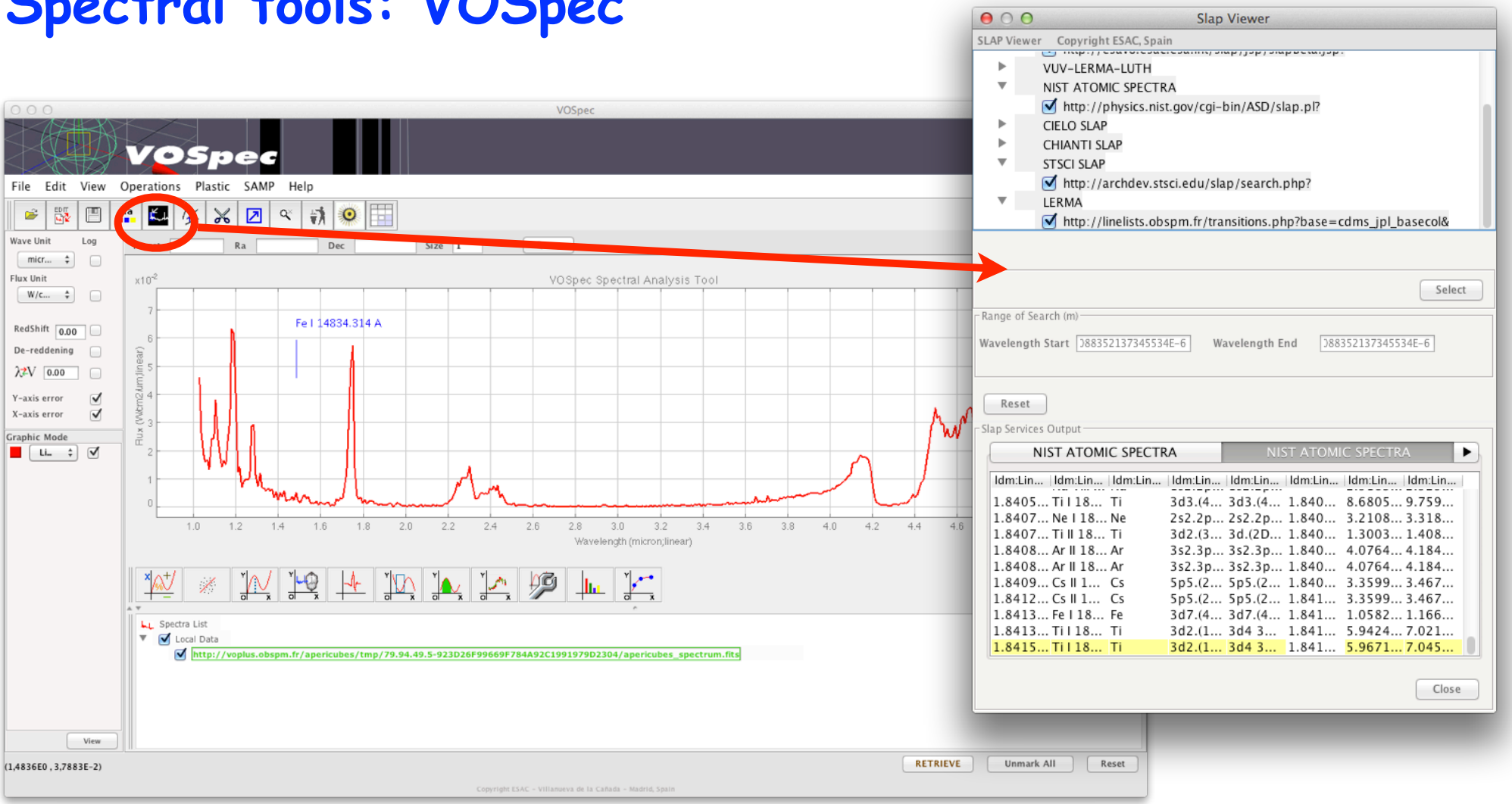
VOSpec receives spectra from APERICubes, but does not recognize units



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

Currently does not understand radiance (W/m^2/sr/µm) or reflectance - being discussed with ESA

Spectral tools: VOSpec



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

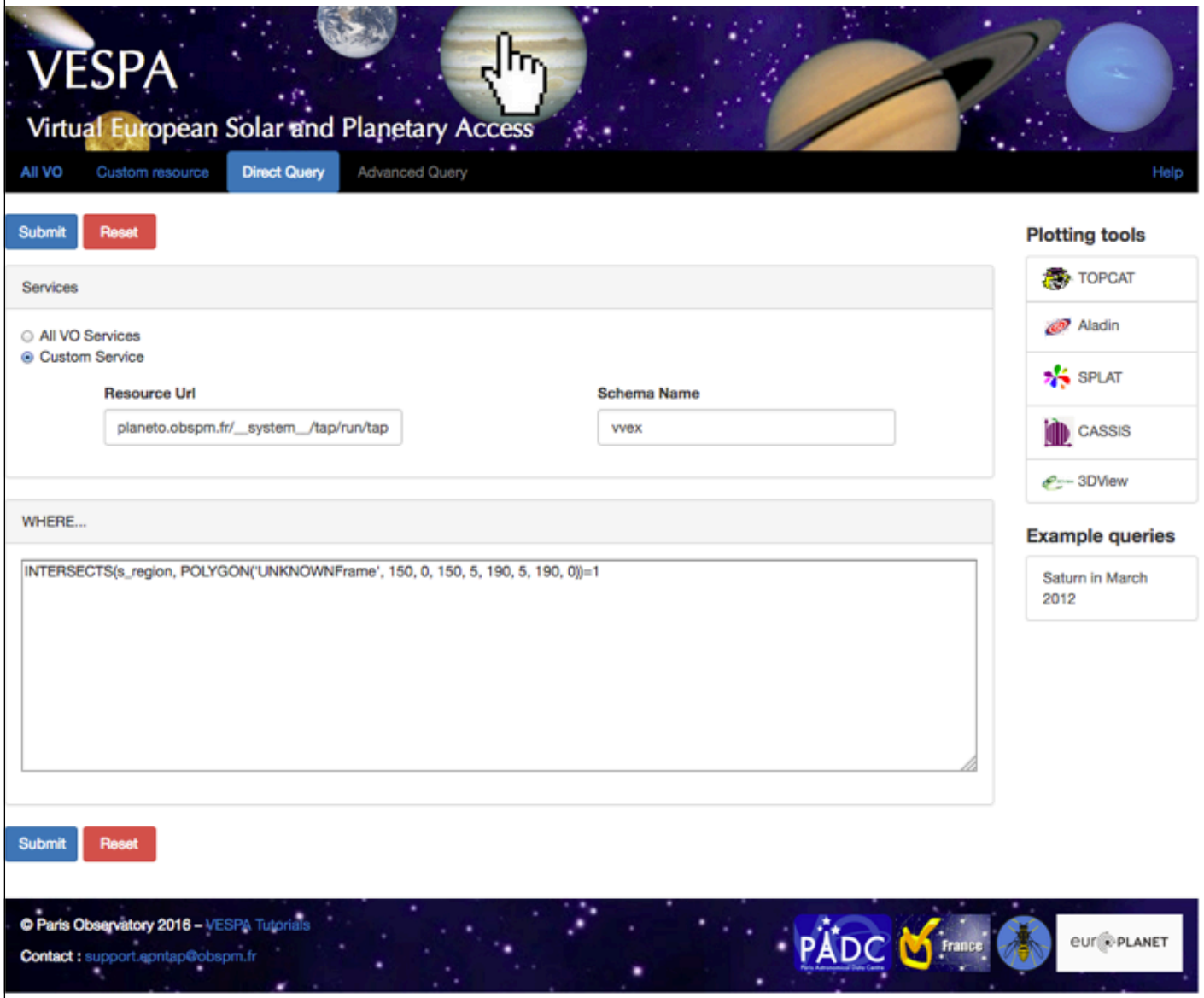
Fitting functions available in "Operations" menu

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

Future developments

- Extension of data service:
  Geometry parameters: illumination angles, disk intercept, tangent altitude, etc
  Enlarge to mission extensions
  Compute all sampled footprints
- Footprints mosaicking (in a GIS or Aladin)
- Support for H cubes in APERICubes / CASSIS (as set of independent spectral orders)
- Stand-alone PDS3 reader/FITS converter (currently implemented in APERICubes)
- Send data to 3Dview, MATISSE?

Powerfull searches on location



In "Direct Query" tab

- Select service

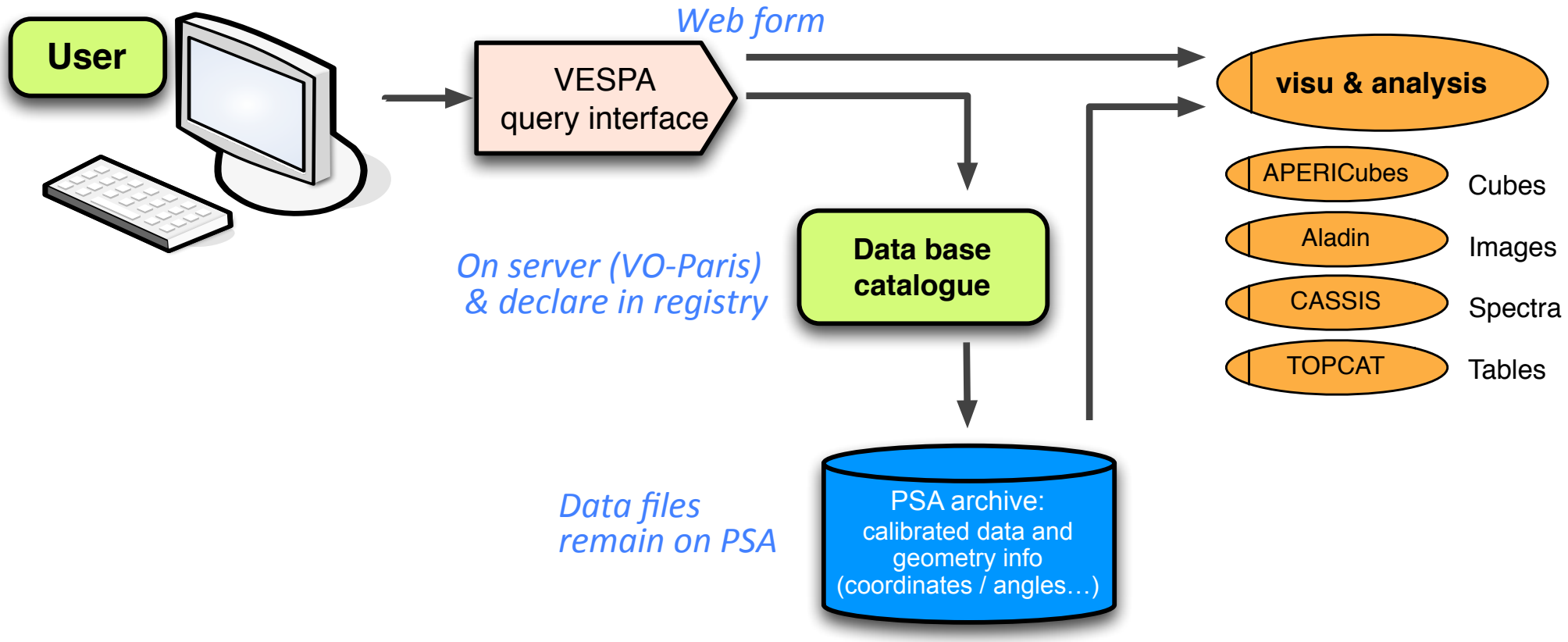
- Enter ADQL query on s_region footprint

Will return cubes with footprint intersecting or containing a polygon, circle, or point

Context

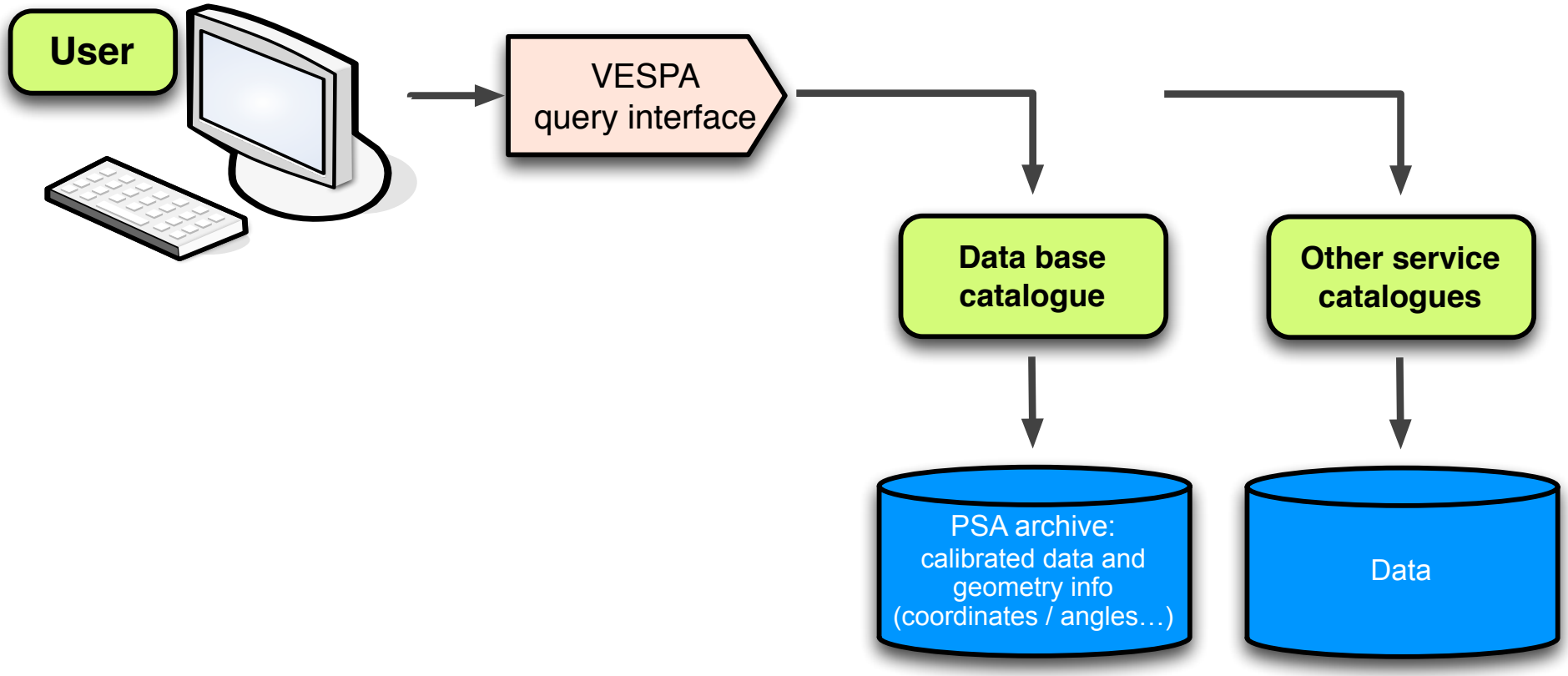
VO functions

- VESPA provides search functions to the PSA VVEx dataset
- TOPCAT provides quick-look of table information
- APERICubes will provide on-line visu & basic analysis functions to a single cube
  Will also provide conversion from PDS3 to VO format (FITS) & link with other VOtools
- Aladin, Specview, CASSIS, etc can display images / cubes / spectra from APERICubes

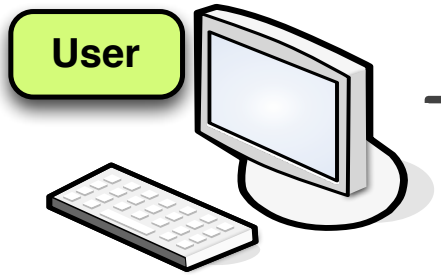


Search other datasets

VESPA sends queries to several data services in parallel. In the long term it will access:
- other VEx instruments
    => Cross correlate all VEx measurements with a single query
- derived data / results of various analyses from VIRTIS (outside PSA)
- reference data, other Venus missions, coordinated ground-based observations, lab spectra, simulations, etc



Possible extension to the Virtis VEx data service



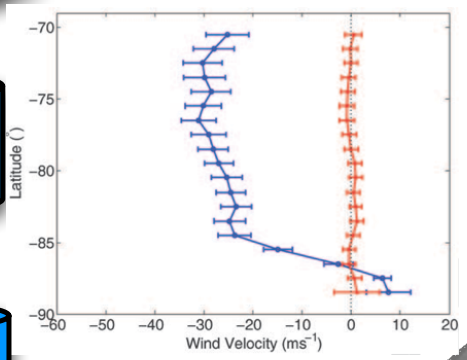
User

VESPA Client

PI inst. service (LESIA, IAPS)

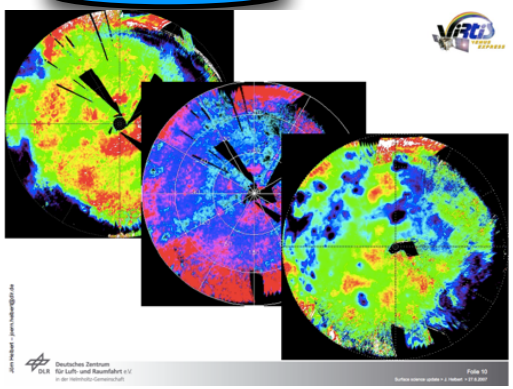
Data base catalogue

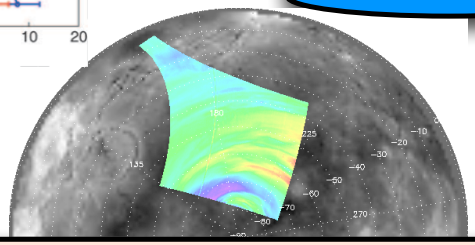
Secondary DB: wind maps



Primary Data base: calibrated data and geometry info (coordinates / angles…)

Secondary DB: surface maps



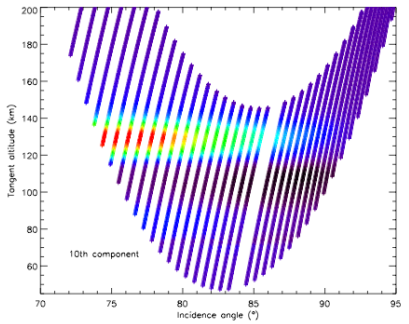


secondary services in col institutes (Bilbao, Berlin, Lisboa, Oxford…)

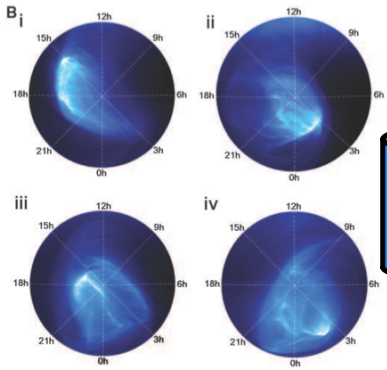
…or one service linking data products in cols institutes

VIRTIS / Venus-Express Data Fuzzy-Center:

Derived products are distributed by associated teams, possibly using a server/catalogue located in PI institutes



Secondary DB: Limb composition



Secondary DB: Atmosphere dynamics

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