



VESPA

Virtual European Solar and Planetary Access

eur@PLANET

# VESPA: Share your data easily

*Developing the Planetary Science Virtual Observatory*

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# «Virtual Observatory» ?

- **Two meanings, same word**

- «A virtual observatory» = a client (usually a web portal) providing access to remote data.

Conceptually close to a «real observatory»: dedicated to a specific science topic.

Examples: VSO (Solar), VMO (Magnetospheric), VWO (Waves)...

- «The virtual observatory» = a series of standards that permit tool interoperability.

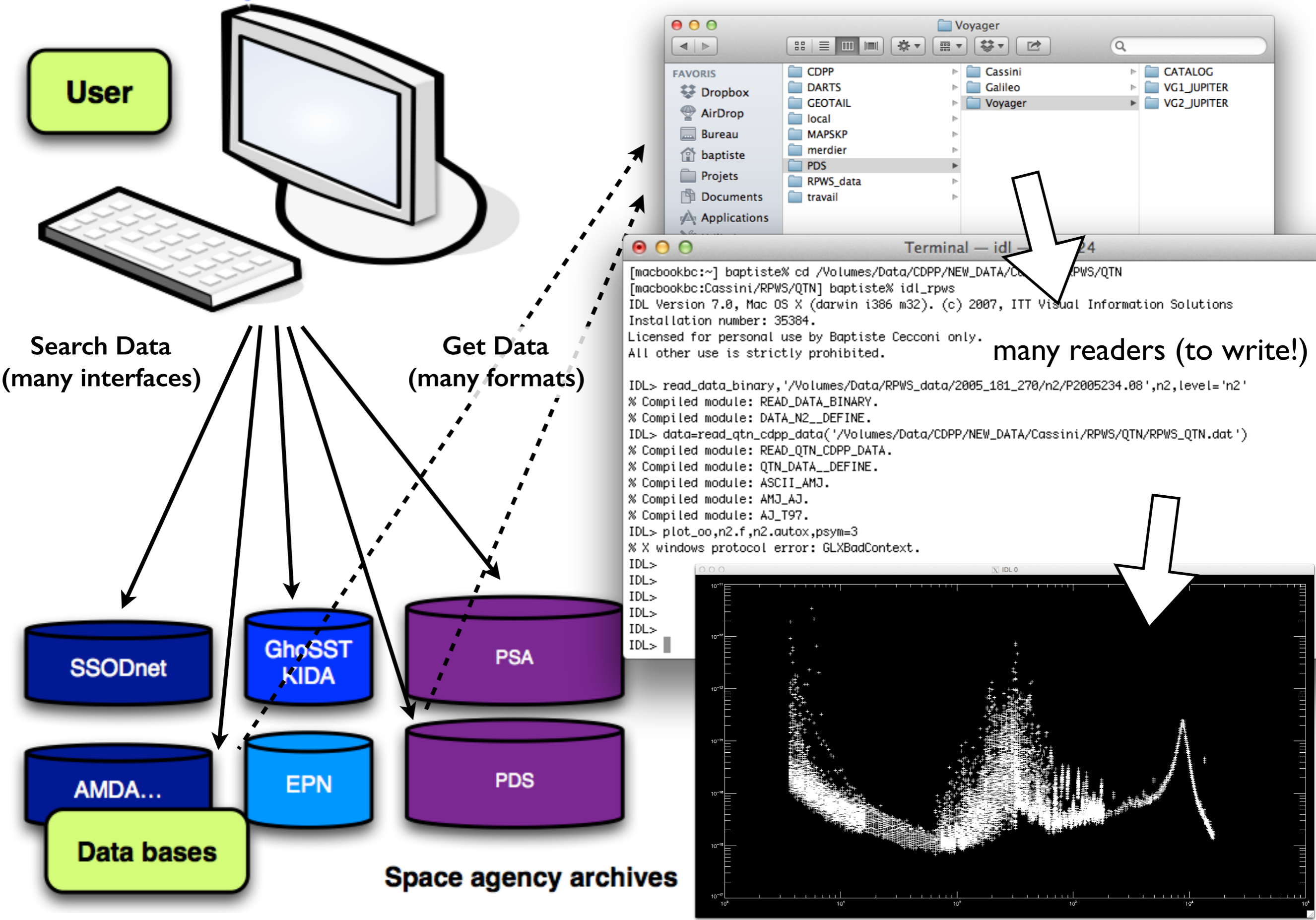
Several sets of standards exist: IVOA (Astro), SPASE (Space Physics)...

- The first is easy to identify: the users connects to it, while the latter is hidden (it only works when you don't see it).

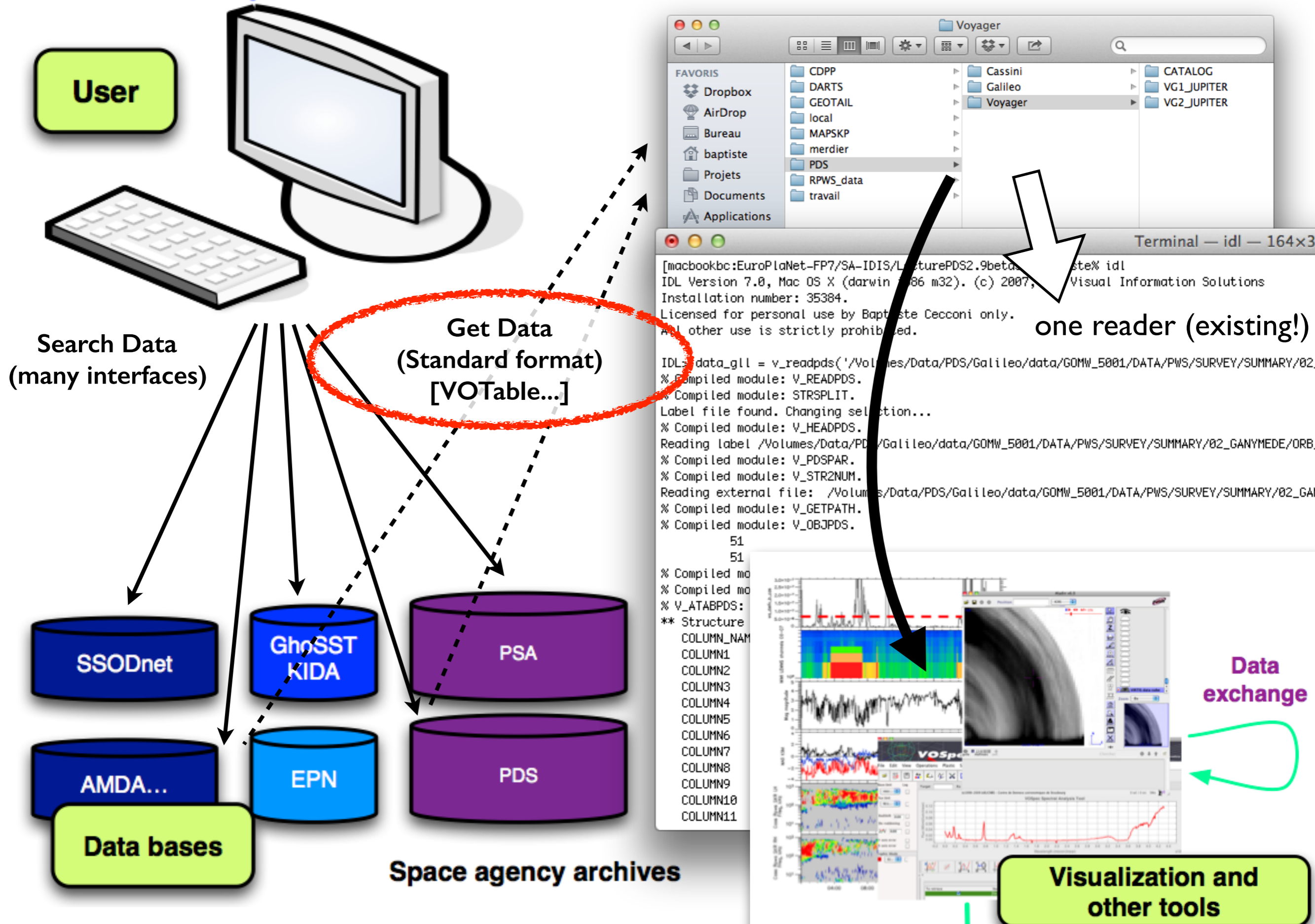
# Interoperable Standard Alliances *for Planets and Solar System*

- IVOA: International Virtual Observatory Alliance *Astrophysics*  
<http://ivoa.net>
- SPASE: Space Physics Archive Search and Extract *Space*  
*Plasma*  
<http://spase-group.org>
- IPDA: International Planetary Data Alliance *Planetary*  
*Sci.*  
<http://planetarydata.org> *(agencies)*
- OGC: Open Geospatial Consortium *Surface Sci.*  
<http://www.opengeospatial.org> *(mainly*  
*Earth)*

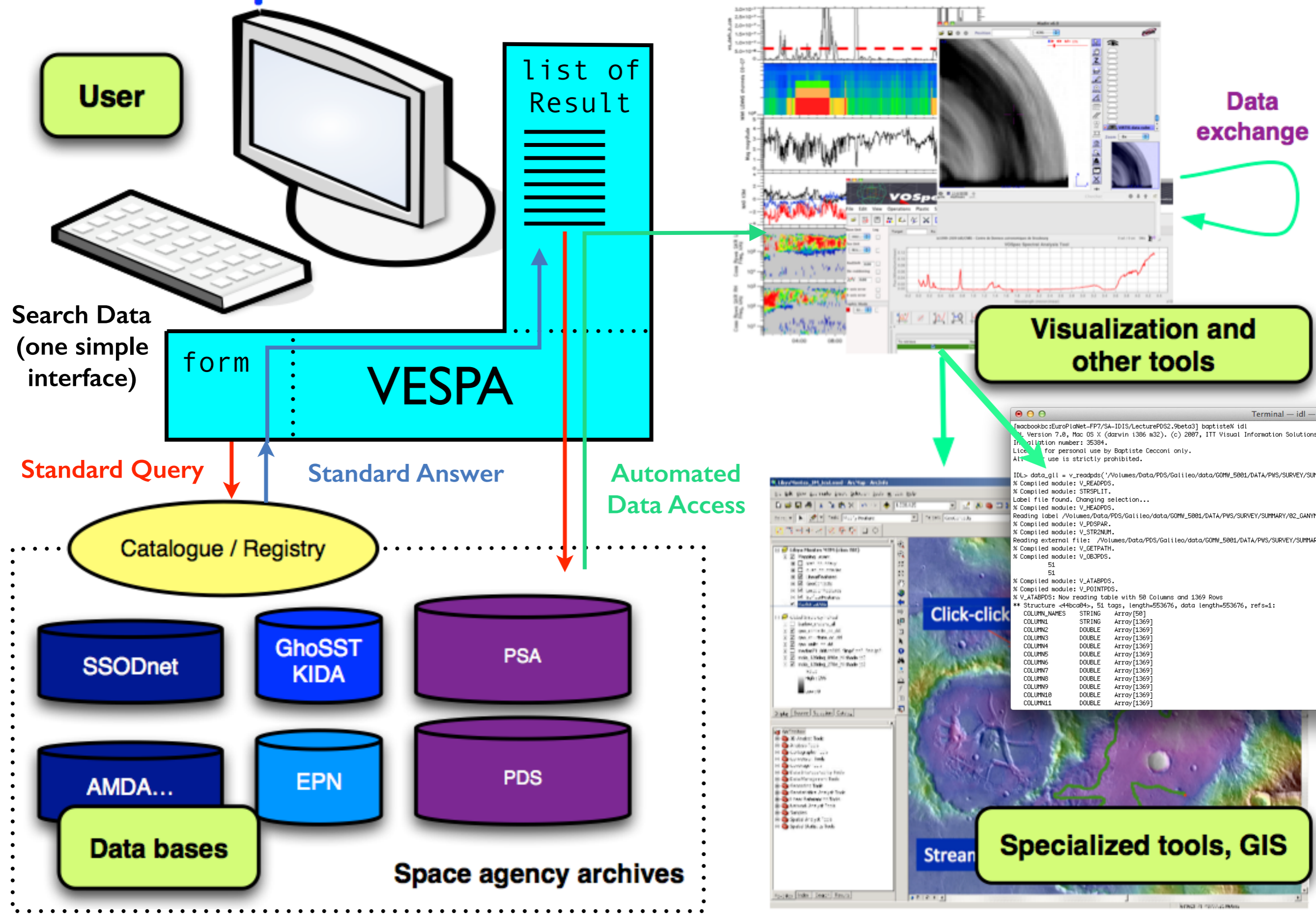
# User's experience «classic»



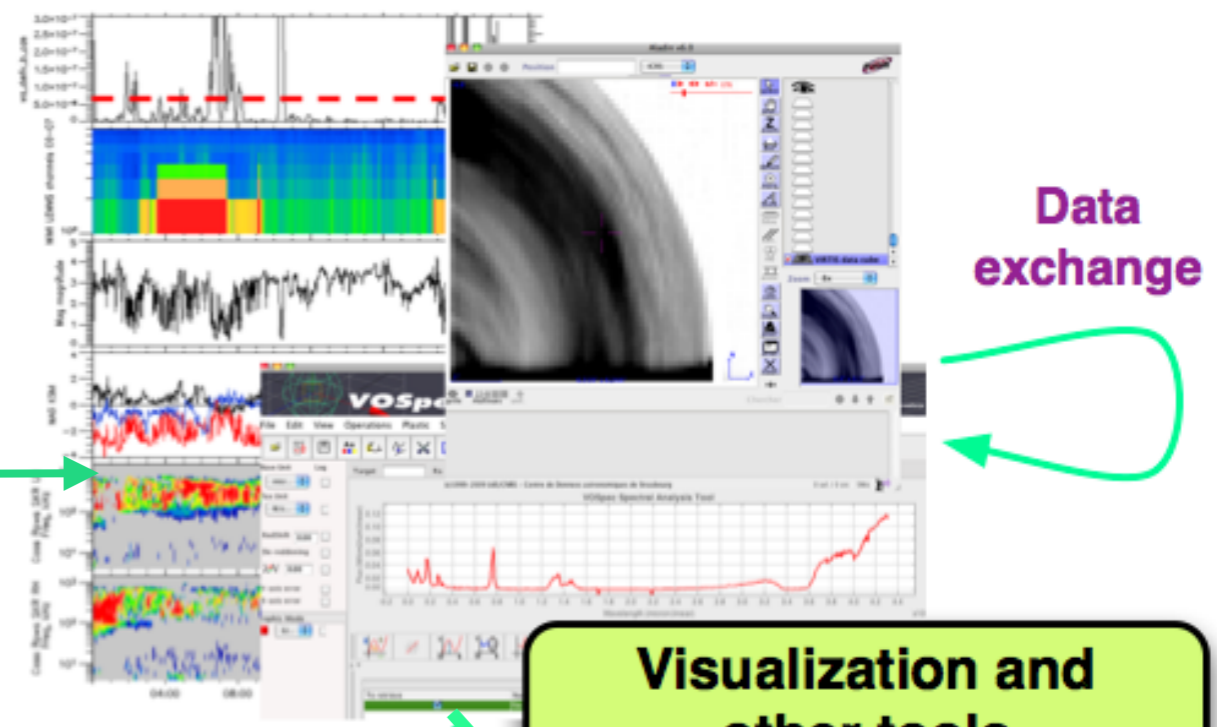
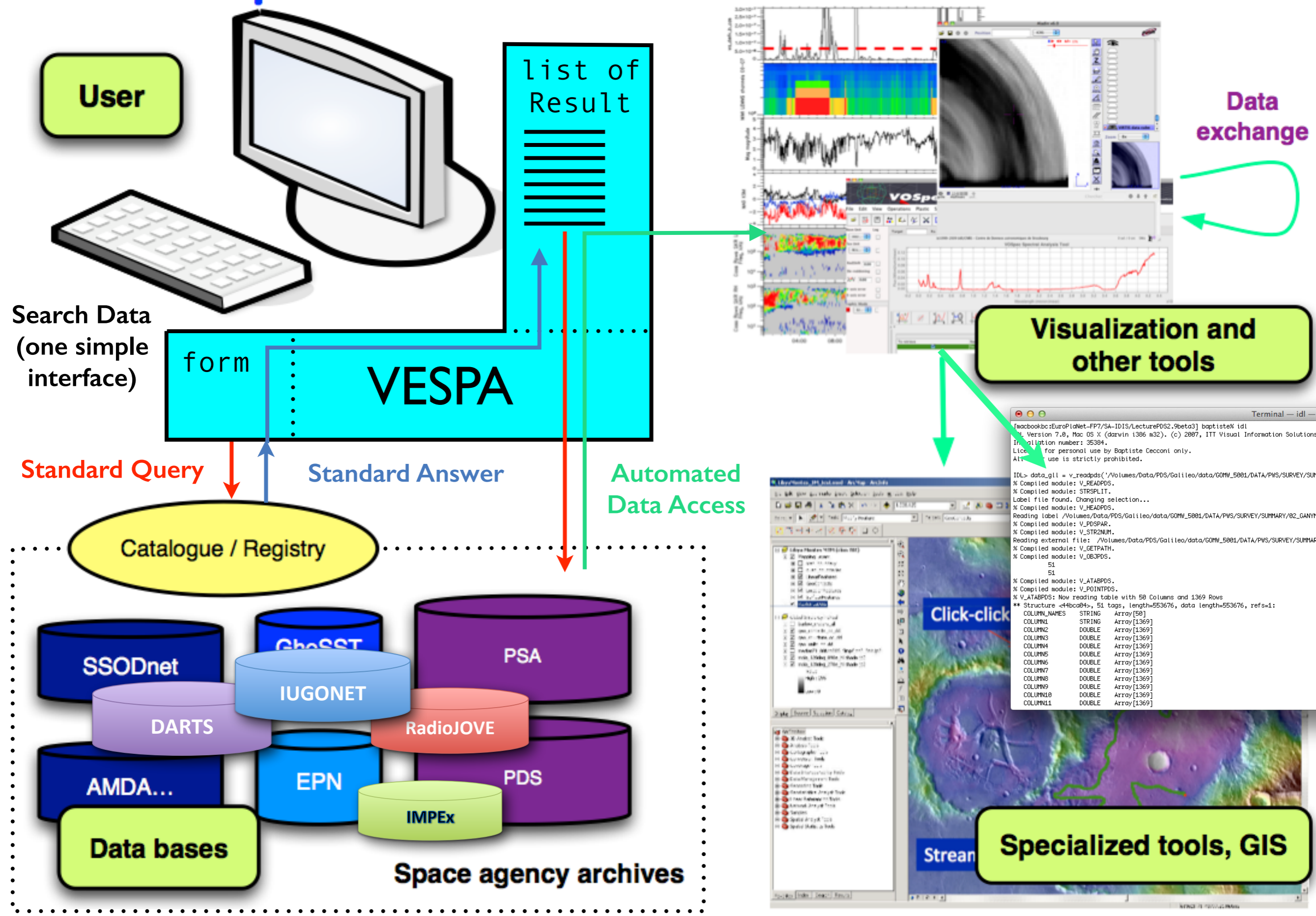
# User's experience «enhanced»



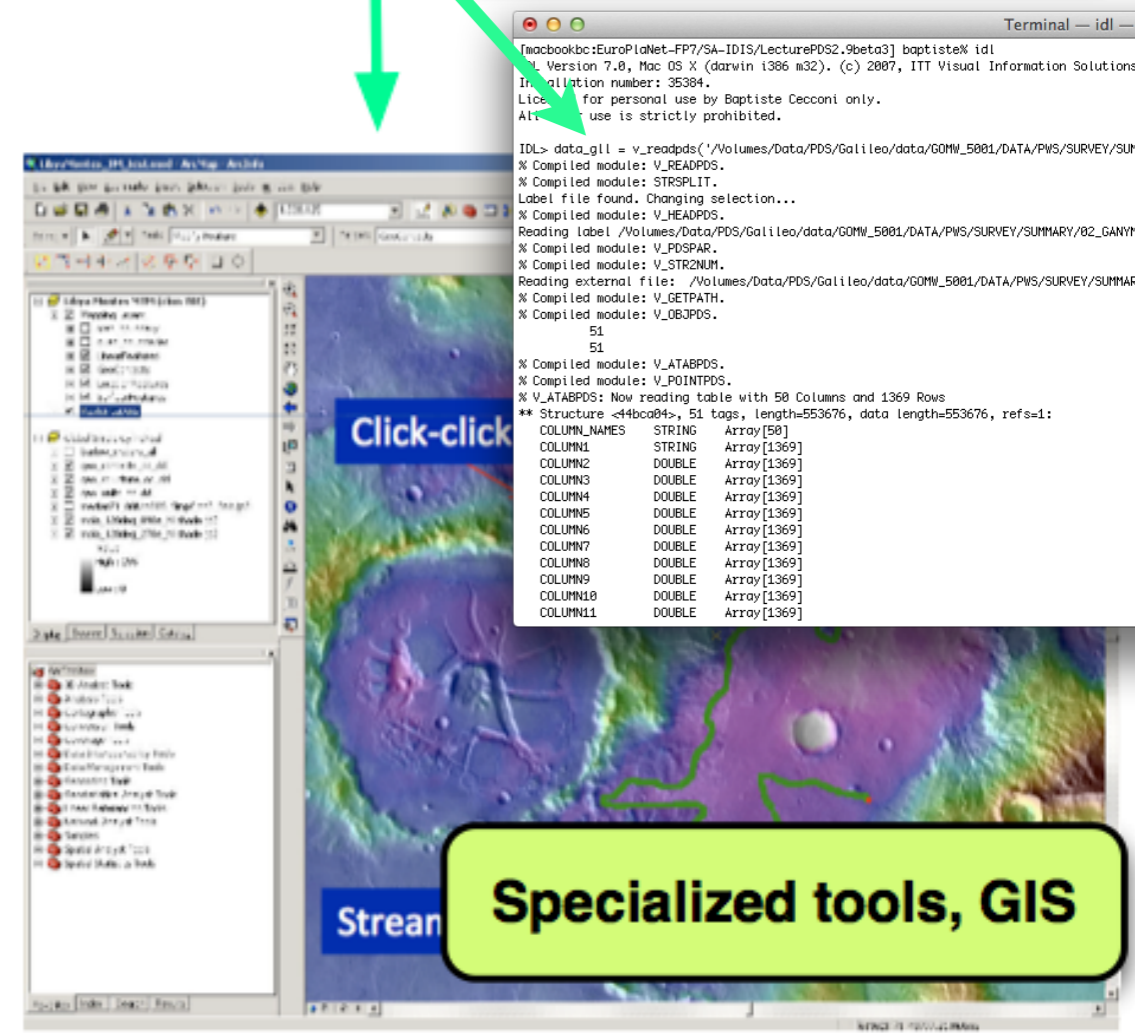
# User's experience «ultimate»



# User's experience «ultimate»



**Visualization and other tools**



**Specialized tools, GIS**

# VESPA Web Portal

Virtual Observatory access: <http://vespa.obspm.fr>

The screenshot displays the VESPA Web Portal interface within a browser window titled "Europlanet Client". The browser address bar shows the URL [voparis-europlanet-dev.obspm.fr/planetary/data/epn/query/all/](http://voparis-europlanet-dev.obspm.fr/planetary/data/epn/query/all/). The page features a header banner with the text "VESPA Virtual European Solar and Planetary Access" and a navigation menu with items like "forums", "Mission", "CDPP", "RPWI - Dropbox", "Cassini", "STEREO", "Webmail", "Banques", "Revues", "English", "YT->MP4", "DOI", and "Reservations [OBSPM]".

The main content area is titled "Query form: All VO" and contains several input fields and dropdown menus for searching data. The fields include:

- Target name:
- Resource type:
- Dataset ID:
- Time selection:  and
- Time min:
- Time max:
- Dataproduct type:
- Measurement type:
- Target class:

On the right side, there is a "Plotting tools" section with a list of icons and names: TOPCAT, Aladin, VOSpec, and SPLAT. Below this is an "Example queries" section with a link to "Saturn in March 2012".

At the bottom right, there is a vertical list of expandable sections: Location +, Spectral +, Time +, Photometry +, Instrument +, and Optional +. At the bottom left, there is a small link "Afficher un menu".



# Result page: search for Jupiter data

**VESPA**  
Virtual European Solar and Planetary Access

All VO Custom resource

## Results in service dam

Show 20 entries Search:  Show / hide columns Select all Deselect all

Data type	Target name	time_min (d)	Interval	time_max (d)	link to data
dynamic_spectrum	jupiter	2012-07-07T06:00:00		2012-07-07T06:00:00	<a href="#">J120707.xml</a>
dynamic_spectrum	jupiter	2012-03-31T18:00:00		2012-03-31T18:00:00	<a href="#">J120331.xml</a>
dynamic_spectrum	jupiter	2013-02-03T18:00:00		2013-02-04T00:00:00	<a href="#">J130203.xml</a>
dynamic_spectrum	jupiter	2012-08-22T00:00:00		2012-08-22T06:00:00	<a href="#">J120822.xml</a>
dynamic_spectrum	jupiter	2011-09-27T00:00:00		2011-09-27T06:00:00	<a href="#">J110927.xml</a>
dynamic_spectrum	jupiter	2013-02-15T18:00:00		2013-02-16T00:00:00	<a href="#">J130215.xml</a>
dynamic_spectrum	jupiter	2012-08-30T00:00:00		2012-08-30T06:00:00	<a href="#">J120830.xml</a>
dynamic_spectrum	jupiter	2011-02-11T18:00:00		2011-02-11T18:00:00	<a href="#">J110211.xml</a>
dynamic_spectrum	jupiter	2011-05-11T06:00:00		2011-05-11T06:00:00	<a href="#">J110511.xml</a>
dynamic_spectrum	jupiter	2012-12-10T18:00:00		2012-12-11T06:00:00	<a href="#">J121210.xml</a>
dynamic_spectrum	jupiter	2012-12-16T18:00:00		2012-12-17T00:00:00	<a href="#">J121216.xml</a>
dynamic_spectrum	jupiter	2012-12-24T18:00:00		2012-12-25T00:00:00	<a href="#">J121224.xml</a>
dynamic_spectrum	jupiter	2012-07-05T06:00:00		2012-07-05T06:00:00	<a href="#">J120705.xml</a>

### Plotting tools

- TOPCAT
- Aladin
- VOSpec
- SPLAT

### Example queries

- Saturn in March 2012

### SELECTED DATA

No data selected

### PREVIEW

Right Handed Polarization

Intensity (10<sup>15</sup> photons m<sup>-2</sup> s<sup>-1</sup> nm<sup>-1</sup>)

Wavelength (nm)

preview J110

# Why IVOA and not SPASE ?

- **SPASE = Space Physics** (plasma, radio...), a lot to add in keyword dictionaries for planetary and solar system sciences.  
This was studied, but it was decided not to go that way;
- **IVOA = generic standards and protocols for astronomy.**
  - Main concern is coordinates (astro = only sky coordinates; solar system = many coordinate systems per planet!).
  - Most access protocols (for tables, spectra, images...) are not built on observed object, but rather on data type. They allow references to other datamodels (such as SPASE)
  - VOTable is very generic. FITS also.
- **Other good thing about IVOA:**
  - there is a registry
  - there are tools to work on tables (TOPCAT), images (Aladin), spectra...
  - there is a very nice application messaging protocol: SAMP (see demo)

# TAP [IVOA]

## *Table Access Protocol*

- Documentation:  
<http://www.ivoa.net/documents/TAP/>
- IVOA protocol for accessing tables.  
Distribution of VOTable (*xml file with metadata and data table*).  
SQL-type query language (ADQL) on the values in the table columns.
- IVOA registry is used to declare TAP services

# EPN-TAP

## *EuroPlaNet-TAP*

- Documentation: <http://discussions.europlanet-vespa.eu>
- Access Protocol for «Planetary Sciences» resources.  
It is a plain TAP service with predefined column names.
- Protocol for **data resource discovery with “coverage search”**.  
19 columns are mandatory (target, time range, spectral range, spatial location, instrument...)
- This was defined in the frame of the Europlanet FP7 project, from IVOA models.
- EPN-TAP Client = VESPA (Virtual European Solar and Planetary Access) <http://vespa.obspm.fr>

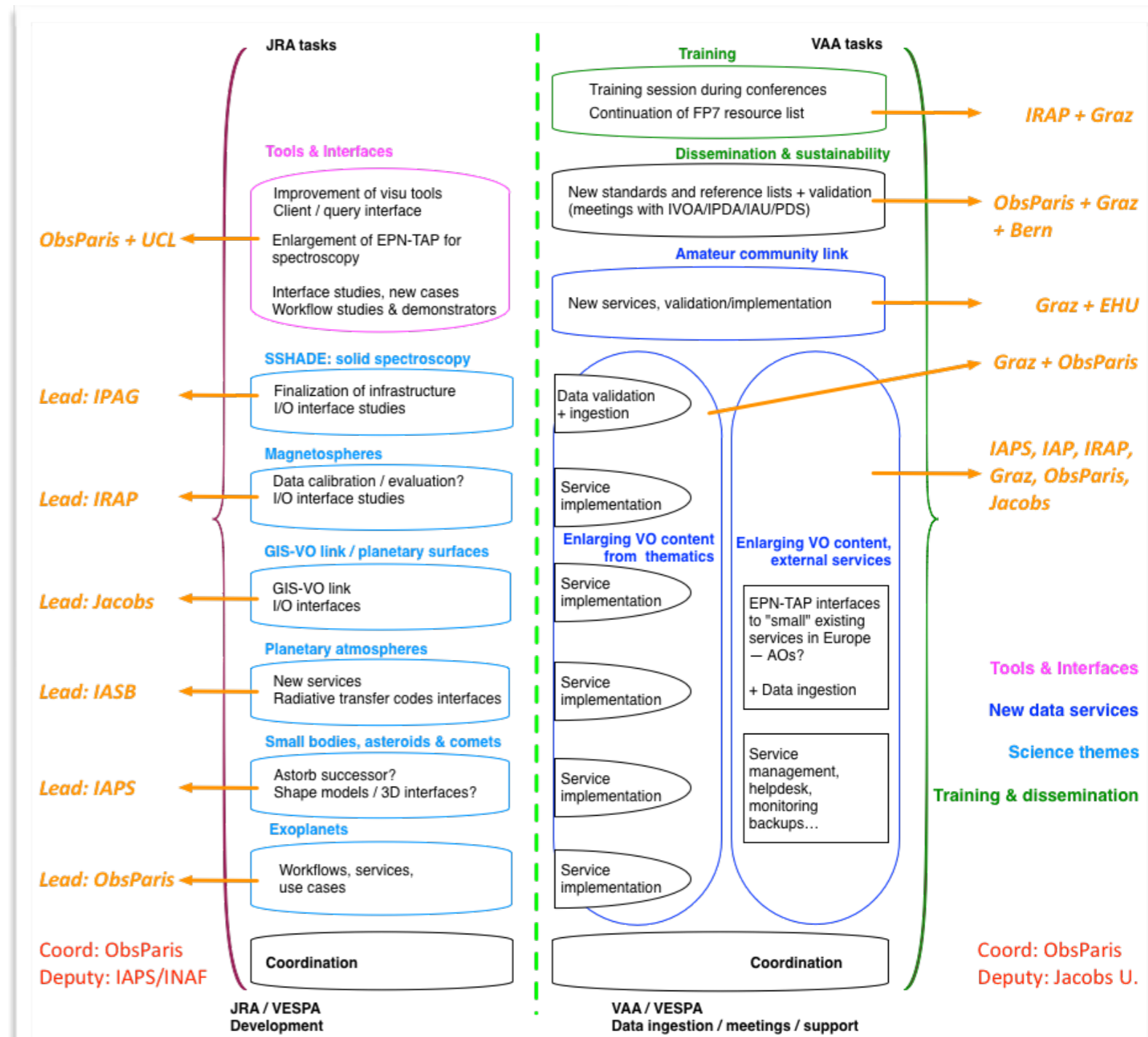
# EPN-TAP Search Parameters

- EPN-TAP = TAP +EPNcore keywords (planetary sciences specific)
- **EPNCore** mandatory keywords:
  - *dataprodect\_type*: Image, spectrum, time series, dynamic spectrum...
  - Observation target: *target\_name*, *target\_class*
  - Temporal parameters: *time\_min*, *time\_max*, *time\_exp\_min*, *time\_exp\_max*, *time\_sampling\_step\_min*, *time\_sampling\_step\_max*
  - Spectral parameters: *spectral\_range\_min*, *spectral\_range\_max*, *spectral\_resolution\_min*, *spectral\_resolution\_max*, *spectral\_sampling\_step\_min*, *spectral\_sampling\_step\_max*
  - Spatial parameters: *spatial\_frame\_type* ('celestial', 'body', 'cartesian', 'cylindrical', 'spherical'), *c1min*, *c2min*, *c3min*, *c1max*, *c2max*, *c3max*, *c1\_resol\_min*, *c2\_resol\_min*, *c3\_resol\_min*, *c1\_resol\_max*, *c2\_resol\_max*, *c3\_resol\_max*
  - Observation geometry: *incidence\_angle*, *emergence\_angle*, *phase\_angle*
  - Instrument: *instrument\_host\_name*, *instrument\_name*
  - Physical parameter: *measurement\_type* (using IVOA UCDs, not SPASE measurement types, but similar)

# Euromplanet-H2020-RI

## VESPA

- VESPA: 1/4 of EPN budget
- VESPA leads: ObsParis + Bremen + Rome
- Goal= Implementing many data services in European labs.
- Yearly AO: invite external teams to learn how to set up VESPA server.



# Europlanet-H2020-RI VESPA

VESPA includes 17 contributing participants:

Observatoire de Paris  
(IMCCE, LESIA)



IAPS/INAF Rome



Jacobs Univ. Bremen



CNRS  
(IRAP IPAG LATMOS  
GEOPS CDS)



IWF Graz



IASB-BIRA Brussels



UCL London



IAP Prague



UPV/EHU Bilbao



IGN/PAS Wrocław



Univ. Bern



GFI Toulouse



# VESPA Tutorials

- **Data User Tutorials:**

<http://typhon.obspm.fr/VESPA-tutorials/index.php?page=1>

Tutorial splinter sessions at EGU and EPSC every year.

This year EGU: Tuesday April 19th Room 2.97 13:30-19:00

- **Data Provider Tutorials:**

<https://voparis-confluence.obspm.fr/display/VES/Implementing+a+VESPA+service>

Yearly AO. This year deadline is Feb 21st ! :-)

<http://www.europlanet-vespa.eu/call2016.shtml>

What kind of data?

- any, but higher-level, derived, published preferred.

- planetary (incl. Earth space plasma), solar, heliosphere, exoplanets...

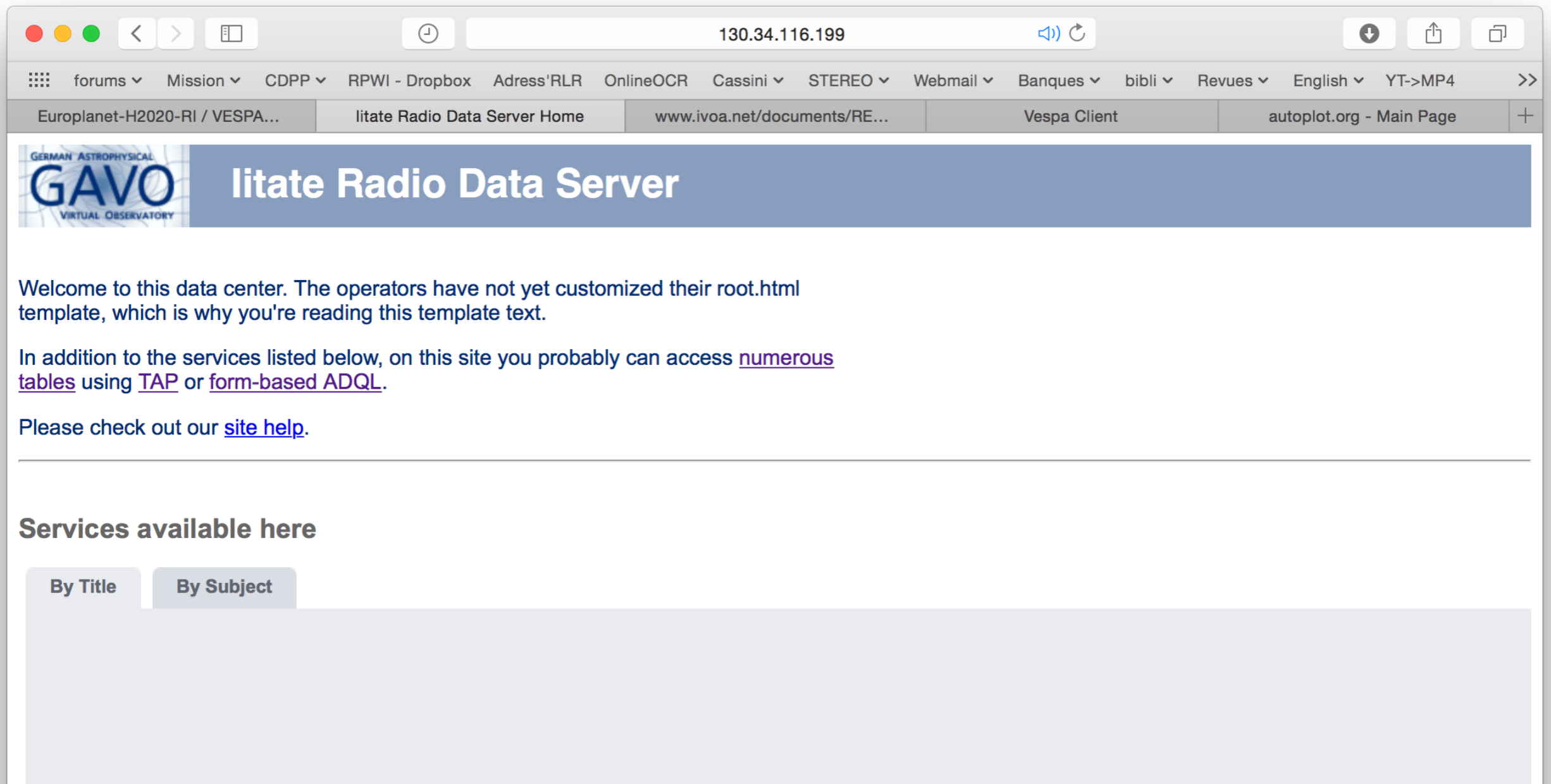
*(simulation run or lab results under study)*



# Example with litate Radio Observatory (Japan)

- Direct access to server:

<http://130.34.116.199>



The screenshot shows a web browser window with the address bar displaying `130.34.116.199`. The browser's navigation bar includes several tabs: "Europlanet-H2020-RI / VESPA...", "litate Radio Data Server Home", "www.ivoa.net/documents/RE...", "Vespa Client", and "autoplot.org - Main Page". The main content area features a blue header with the GAVO logo (German Astrophysical Virtual Observatory) and the text "litate Radio Data Server". Below the header, a welcome message states: "Welcome to this data center. The operators have not yet customized their root.html template, which is why you're reading this template text." It also mentions that users can access "numerous tables using TAP or form-based ADQL" and provides a link to "site help". At the bottom, there is a section titled "Services available here" with two tabs: "By Title" and "By Subject".

# Example with Iitate Radio Observatory (Japan)

- Direct access to server:

<http://130.34.116.199>

- Example of ADQL queries

- *Target+Time interval+Access*

[select target\\_name,time\\_min,time\\_max,access\\_url,access\\_estsize from iitate.epn\\_core](#)

- *Time and spectral resolution*

[select distinct time\\_sampling\\_step\\_min,spectral\\_sampling\\_step\\_min from iitate.epn\\_core](#)

- Access through VESPA portal:

<http://vespa.obspm.fr/planetary/data/epn/query/resource/>

Resource URL: [http://130.34.116.199/\\_\\_system\\_\\_/tap/run/tap](http://130.34.116.199/__system__/tap/run/tap)

Schema Name : iitate



## ADQL Query

- Help
- Service info

### Related

[Tables available for ADQL](#)

### Metadata

- Identifier >>
- Description >>
- Keywords >>
- Creator >>
- Created >>
- Data updated >>
- Reference URL >>

[Try ADQL](#) to query our data.

Please report errors and problems to the [site operators](#). Thanks.  
[Privacy](#) | [Disclaimer](#)  
[Log in](#)

On this page, you can use [ADQL](#) to query [some of our tables](#). This is mainly for dabbling; use [TAP](#) for larger jobs (e.g., [using TAPHandle](#) within your browser).

To learn what ADQL is or for further information on this implementation, see the [service info](#).

ADQL query

```
select distinct time_sampling_step_min,spectral_sampling_step_min from iitate.epn_core
```

*A query in the Astronomical Data Query Language*

Timeout after [s]

Seconds until the query is aborted. If you find yourself having to raise this beyond 200 or so, please contact the site operators for hints on how to optimize your query

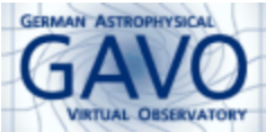
Output format

[\[Result link\]](#) ★

To protect your nerves, the server inserts a TOP 2000 phrase unless you give a limit yourself. Thus, if you hit the 2000 record limit and want to override it, you can specify your limit yourself (like `SELECT TOP 20000...`).

There is a fixed limit to 100000 rows on this service. If this bugs you, use [TAP](#).

Afficher un menu



Help

Service info

Related

[Tables available for ADQL](#)

Metadata

- Identifier >>
- Description >>
- Keywords >>
- Creator >>
- Created >>
- Data updated >>
- Reference URL >>

[Try ADQL](#) to query our data.

Please report errors and problems to the [site operators](#). Thanks.  
[Privacy](#) | [Disclaimer](#)  
[Log in](#)

Afficher un menu

# ADQL Query

## Parameters

- ADQL query: select distinct time\_sampling\_step\_min,spectral\_sampling\_step\_min from iitate.epn\_core

## Result

Matched: 1

[Send via SAMP](#) [Quick Plot](#)

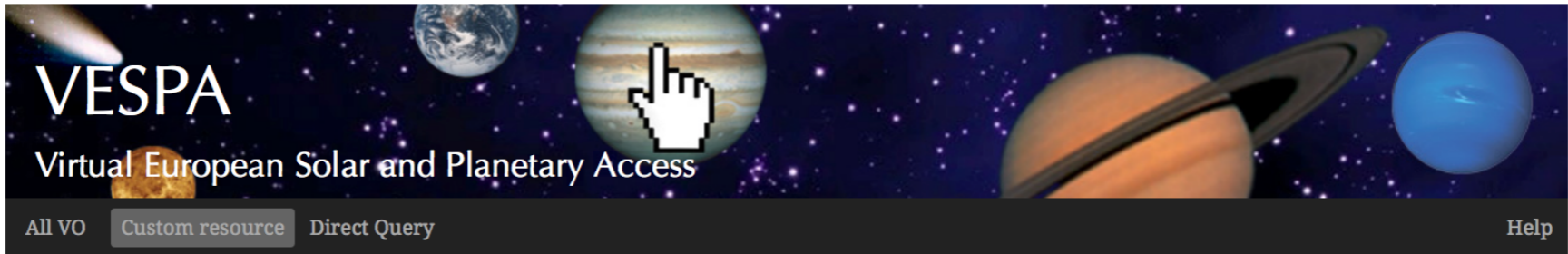
Time_sampling_step_min [s]	Spectral_sampling_step_min [Hz]
1.0	35764.0

## Query Form

On this page, you can use [ADQL](#) to query [some of our tables](#). This is mainly for dabbling; use [TAP](#) for larger jobs (e.g., using [TAPHandle](#) within your browser).

To learn what ADQL is or for further information on this implementation, see the [service info](#).

ADQL query	<pre>select distinct time_sampling_step_min,spectral_sampling_step_min from iitate.epn_core</pre>
------------	---



### Query form: custom resource

Resource URL	<input type="text" value="http://130.34.116.199/__system"/>	Schema name	<input type="text" value="iitate"/>
Target name	<input type="text"/>	Target class	<input type="text" value="asteroid"/> <input type="text" value="comet"/> <input type="text" value="dwarf_planet"/> <input type="text" value="exoplanet"/> <input type="text" value="interplanetary_medium"/> <input type="text" value="planet"/>
Resource type	<input type="text" value="granule"/>		
Dataset ID	<input type="text"/>		
Time selection	<input type="text" value="Data range is included in"/>		<input type="text" value="the range between"/>
Time min	<input type="text" value="2015-02-01T00:00:00.00"/>		Time max <input type="text" value="2015-03-01T00:00:00.00"/>
Dataproduct type	<input type="text" value="image"/> <input type="text" value="spectrum"/> <input type="text" value="dynamic_spectrum"/> <input type="text" value="spectral_cube"/>	Measurement type	<input type="text"/>

Location +  
 Spectral +  
 Time +  
 Photometry +  
 Instrument +  
 Optional +

### Plotting tools

- TOPCAT
- Aladin
- VOSpec
- SPLAT

### Example queries

- [Saturn in March 2012](#)



### Query results for specific schema : iitate

granule ▾

#### Plotting tools

- TOPCAT
- Aladin
- VOSpec
- SPLAT

#### EPN Resources

**Custom resource for schema: iitate** ✓

Results : 28

[DISPLAY RESULTS](#) [DISPLAY VOTABLE](#) [SAMP VOTABLE](#) [ADVANCED QUERY FORM](#)

► [Description :](#)

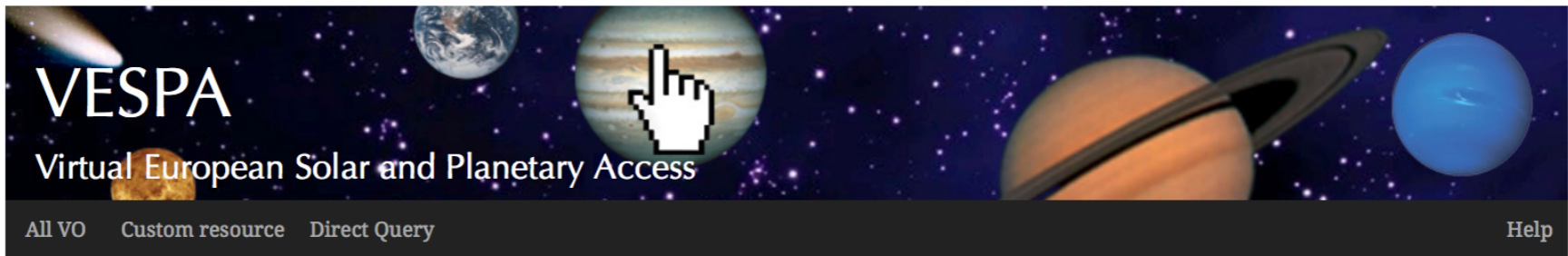
[Credits:](#)

Generated WHERE clause of ADQL statement:

```
SELECT * FROM ... WHERE time_max <= 2457082.50000000 AND time_min >= 2457054.50000000 AND resource_type = 'granule'
```

#### Example queries

- [Saturn in March 2012](#)



## Results in service iitate

Show  entries Search:  [Full Text](#) Show / hide columns Select all Deselect all

dataproduct_type	target_name	time_min (d)	time_max (d)	access_url
dynamic_spectrum	Jupiter	2015-02-01T00:00:00	2015-02-01T23:59:59.500	it_h1_hf_20150201_v01.cdf
dynamic_spectrum	Jupiter	2015-02-02T00:00:00	2015-02-02T23:59:59.500	it_h1_hf_20150202_v01.cdf
dynamic_spectrum	Jupiter	2015-02-03T00:00:00	2015-02-03T23:59:59.500	it_h1_hf_20150203_v01.cdf
dynamic_spectrum	Jupiter	2015-02-04T00:00:00	2015-02-04T23:59:59.500	it_h1_hf_20150204_v01.cdf
dynamic_spectrum	Jupiter	2015-02-05T00:00:00	2015-02-05T23:59:59.500	it_h1_hf_20150205_v01.cdf
dynamic_spectrum	Jupiter	2015-02-06T00:00:00	2015-02-06T23:59:59.500	it_h1_hf_20150206_v01.cdf
dynamic_spectrum	Jupiter	2015-02-07T00:00:00	2015-02-07T23:59:59.500	it_h1_hf_20150207_v01.cdf
dynamic_spectrum	Jupiter	2015-02-08T00:00:00	2015-02-08T23:59:59.500	it_h1_hf_20150208_v01.cdf
dynamic_spectrum	Jupiter	2015-02-09T00:00:00	2015-02-09T23:59:59.500	it_h1_hf_20150209_v01.cdf
dynamic_spectrum	Jupiter	2015-02-10T00:00:00	2015-02-10T23:59:59.500	it_h1_hf_20150210_v01.cdf
dynamic_spectrum	Jupiter	2015-02-11T00:00:00	2015-02-11T23:59:59.500	it_h1_hf_20150211_v01.cdf
dynamic_spectrum	Jupiter	2015-02-12T00:00:00	2015-02-12T23:59:59.500	it_h1_hf_20150212_v01.cdf
dynamic_spectrum	Jupiter	2015-02-13T00:00:00	2015-02-13T23:59:59.500	it_h1_hf_20150213_v01.cdf
dynamic_spectrum	Jupiter	2015-02-14T00:00:00	2015-02-14T23:59:59.500	it_h1_hf_20150214_v01.cdf
dynamic_spectrum	Jupiter	2015-02-15T00:00:00	2015-02-15T23:59:59.500	it_h1_hf_20150215_v01.cdf
dynamic_spectrum	Jupiter	2015-02-16T00:00:00	2015-02-16T23:59:59.500	it_h1_hf_20150216_v01.cdf
dynamic_spectrum	Jupiter	2015-02-17T00:00:00	2015-02-17T23:59:59.500	it_h1_hf_20150217_v01.cdf
dynamic_spectrum	Jupiter	2015-02-18T00:00:00	2015-02-18T23:59:59.500	it_h1_hf_20150218_v01.cdf
dynamic_spectrum	Jupiter	2015-02-19T00:00:00	2015-02-19T23:59:59.500	it_h1_hf_20150219_v01.cdf
dynamic_spectrum	Jupiter	2015-02-20T00:00:00	2015-02-20T23:59:59.500	it_h1_hf_20150220_v01.cdf

Showing 1 to 20 of 28 entries

Download selection SAMP selection as SAMP VOTable selection SAMP all VOTable

## Plotting tools

- TOPCAT
- Aladin
- VOSpec
- SPLAT

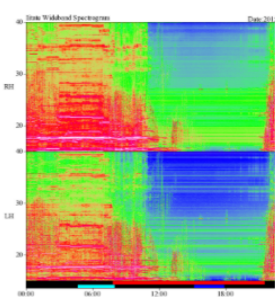
## Example queries

- Saturn in March 2012

## SELECTED DATA

- 1 selected data
- 1 : dynamic\_spectrum

## PREVIEW



# EXAMPLES

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- Examples extracted from online videos produced for EPSC-2013 (London).  
<http://voparis-europlanet.obspm.fr/docum.shtml>
- **Two examples shown here:**
  - **Auroral Physics at Saturn:**
    - Data: in situ plasma data (CDPP, Fr) + images from HST (APIS, Fr)
    - Tools: AMDA (CDPP, Fr), Aladin (CDS, Fr)
    - VO standard used: EPN-TAP, SAMP, FITS, VOTable
  - **Solar Wind interaction with Mars:**
    - Data: in situ plasma data (CDPP, Fr) + plasma simulation (LATMOS, Fr)
    - Tools: AMDA (CDPP, Fr), LatHyS (LATMOS, Fr), TOPCAT (UK)
    - VO Standard used: SAMP, SPASE, VOTable



# EXAMPLE 1: AURORAL PHYSICS AT SATURN

The screenshot displays the AMDA web interface. On the left, the 'Workspace Explorer' shows a tree of parameters under 'Local Data', with 'NASA\_ESA\_ASI\_Mission\_to\_Saturn' selected. The main area is the 'Plot' configuration window, which is set to 'Plot 1' and contains a table of panel properties.

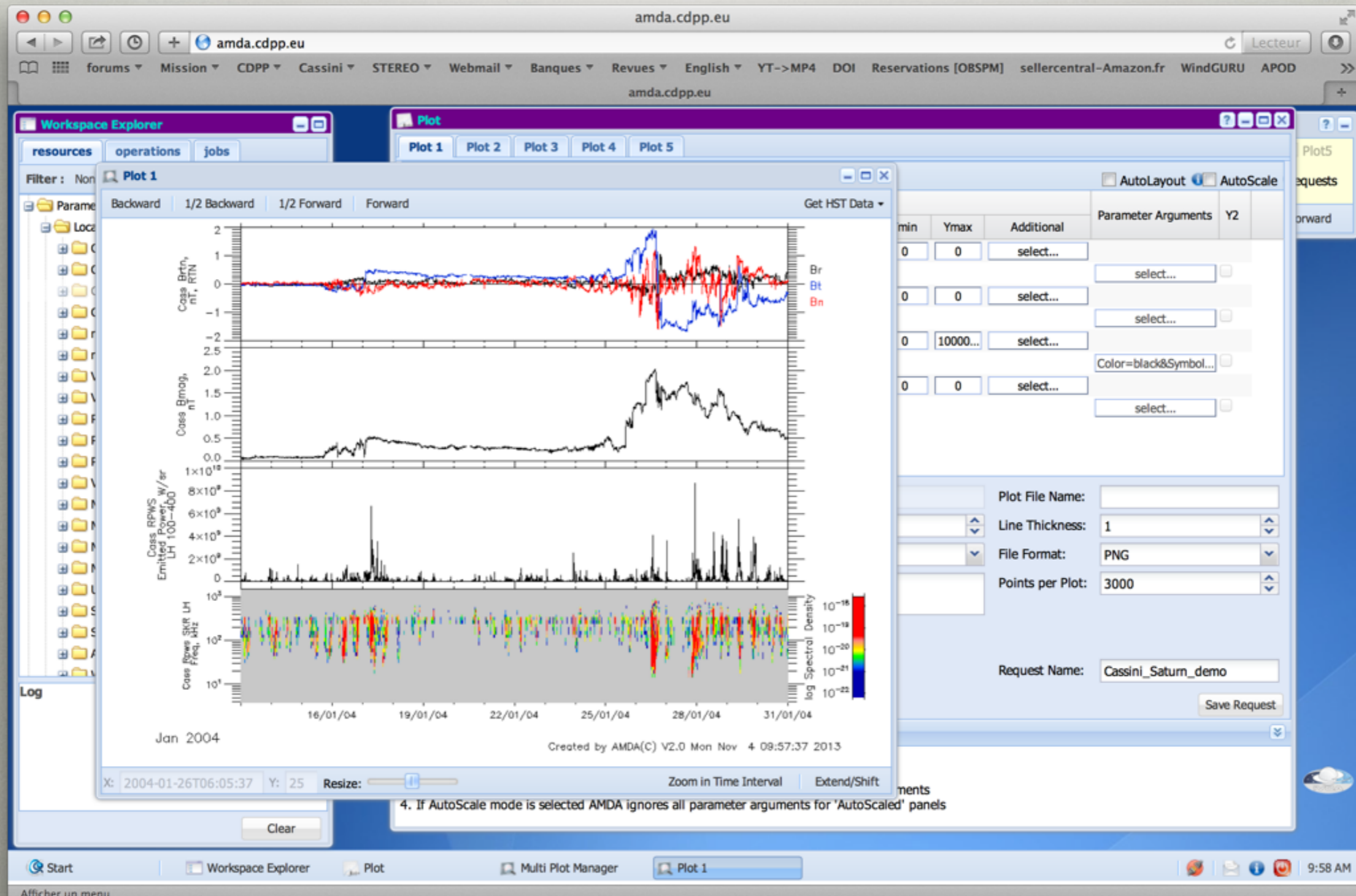
Name	Plot Type	Height	Width	Xmin	Xmax	Ymin	Ymax	Additional	Parameter Arguments	Y2
Panel 1	TIME	0.4	1	0	0	0	0	select...		
cass_b_rtn1s									select...	
Panel 2	TIME	0.4	1	0	0	0	0	select...		
cass_bmag_rt...									select...	
Panel 3	TIME	0.4	1	0	0	0	10000...	select...		
skr_lh_e(0)									Color=black&Symbol...	
Panel 4	TIME	0.4	1	0	0	0	0	select...		
skr_lh									select...	

Below the table, the 'Time Selection' section is set to 'Interval' with a start time of 2004/01/13 00:00 and a stop time of 2004/01/31 00:00. The 'Plot Title' is empty, 'Char Size' is 1.3, 'Orientation' is LANDSCAPE, and 'Plot File Name' is empty. The 'Request Name' is 'Cassini\_Saturn\_demo'. Buttons for 'Plot', 'Get Data', 'Reset', and 'Save Request' are visible.

**Information**

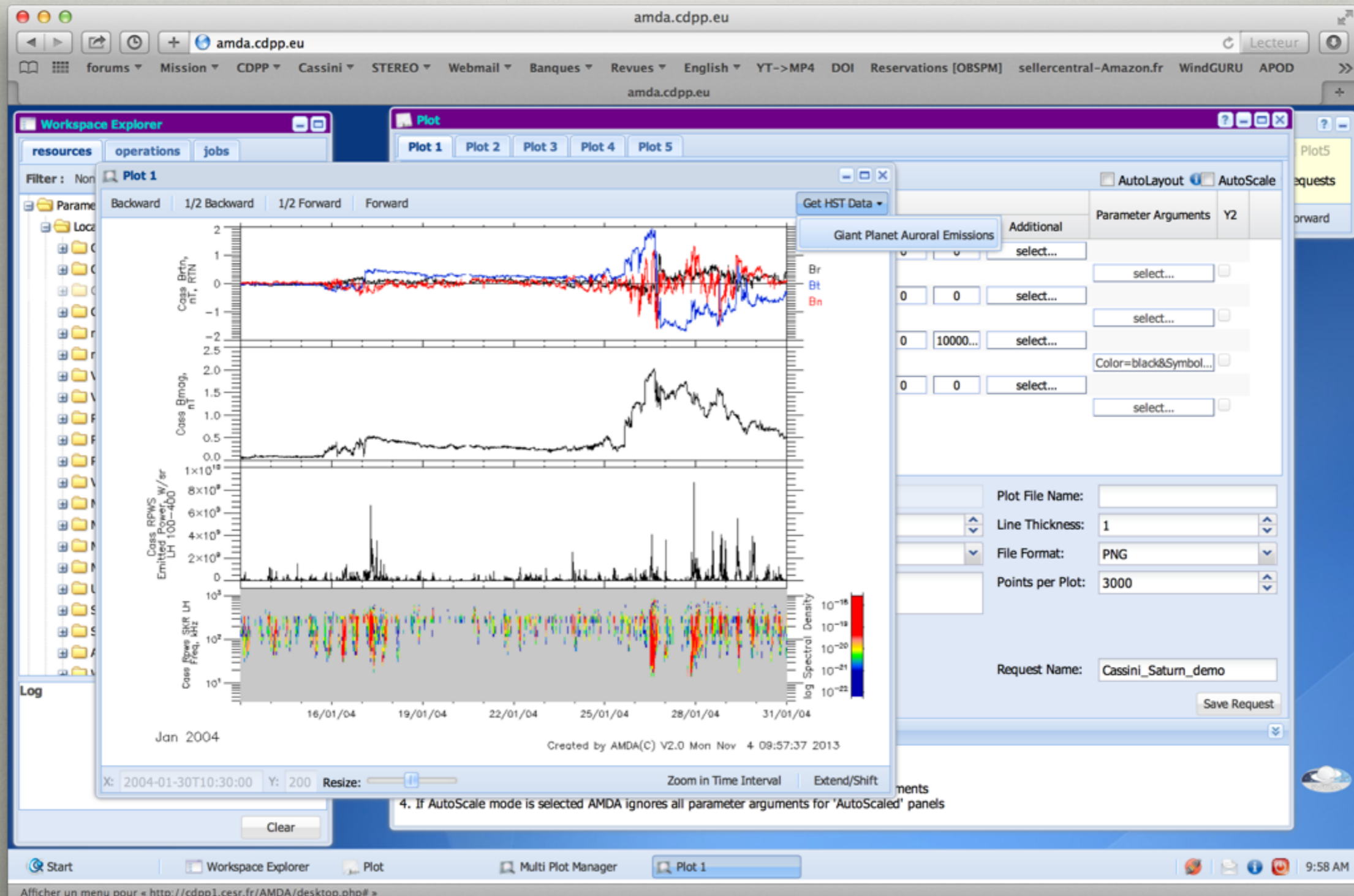
1. To plot a parameter, **drag** it from the Parameters tree and **drop** onto the panel
2. Y2-axis option is not implemented yet
3. XY ('Scatter') PlotType takes into account only 'Symbol' and 'Color' parameter arguments
4. If AutoScale mode is selected AMDA ignores all parameter arguments for 'AutoScaled' panels

# EXAMPLE 1: AURORAL PHYSICS AT SATURN



Plot result

# EXAMPLE 1: AURORAL PHYSICS AT SATURN



HST data access menu

# EXAMPLE 1: AURORAL PHYSICS AT SATURN

The screenshot displays the AMDA (Astronomical Metadata Data Access) web interface. The main window is titled "Astronomical Images" and is divided into several sections:

- Request definition:** Target: Saturn; Start Time: 2004/01/13 00:00; Stop Time: 2004/01/31 00:00; Duration: 0018 00 00 00; Delta T: 0 minute(s); Extend: left, right, both; Shift: left, right.
- Image Selection:** Collapse all, Expand all, Select all, Unselect all. Images: 2004-01-14 (6 images). Selected image: 2004-01-14 04:23:29 - Original data. Metadata: Name: o8wi04rtq\_proc.fits; Start time: 2004-01-14 04:23:29; Stop time: 2004-01-14 09:03:34; Exposure time: 0.194499827777778; Target: saturn; Instrument: FUV-MAMA.
- Interoperability:** Display Mode: [dropdown].

The interface also features a "Workspace Explorer" on the left, a "Log" window at the bottom, and a "Save Request" button. The browser address bar shows the URL: [http://voparis-srv.obspm.fr/vo/planeto/apis/dataset/Bastet/Saturn\\_-\\_2004\\_08-30\\_Jan/o8wi04rtq\\_x2d.jpg](http://voparis-srv.obspm.fr/vo/planeto/apis/dataset/Bastet/Saturn_-_2004_08-30_Jan/o8wi04rtq_x2d.jpg).

Access to APIS data through EPN-TAP

# EXAMPLE 1: AURORAL PHYSICS AT SATURN

The screenshot displays the 'amda.cdpp.eu' web interface. The main window is titled 'Astronomical Images' and contains several sections:

- Request definition:** Target: Saturn, Start Time: 2004/01/13 00:00, Stop Time: 2004/01/31 00:00, Duration: 0018 00 00 00, Delta T: 0 minute(s).
- Image Selection:** A list of image folders and individual files. A popup window shows metadata for a selected image: Name: o8wi11huq\_proc.fits, Start time: 2004-01-26 18:44:52, Stop time: 2004-01-26 23:24:57, Exposure time: 0.1944998611111111, Target: saturn, Instrument: FUV-MAMA.
- Plot:** A plot showing auroral data with a color scale on the right. The plot has a y-axis labeled 'Br', 'Bt', 'Bn' and an x-axis with dates in Jan 2004.
- Parameters:** A table with columns 'min', 'Ymax', 'Additional', 'Parameter Arguments', and 'Y2'. It contains several rows with 'select...' buttons.
- Plot Settings:** Plot File Name, Line Thickness: 1, File Format: PNG, Points per Plot: 3000, Request Name: Cassini\_Saturn\_demo, and a 'Save Request' button.

The interface also shows a 'Workspace Explorer' on the left and a 'Log' section at the bottom. The browser address bar shows the URL: [http://voparis-srv.obspm.fr/vo/planeto/apis/dataset/Bastet/Saturn\\_-\\_2004\\_08-30\\_Jan/o8wi11huq\\_x2d.jpg](http://voparis-srv.obspm.fr/vo/planeto/apis/dataset/Bastet/Saturn_-_2004_08-30_Jan/o8wi11huq_x2d.jpg)

Access to APIS metadata through EPN-TAP

# EXAMPLE 1: AURORAL PHYSICS AT SATURN

The screenshot displays the AMDA (Astronomical Metadata Data Access) web interface. The main window is titled "Astronomical Images" and is divided into several sections:

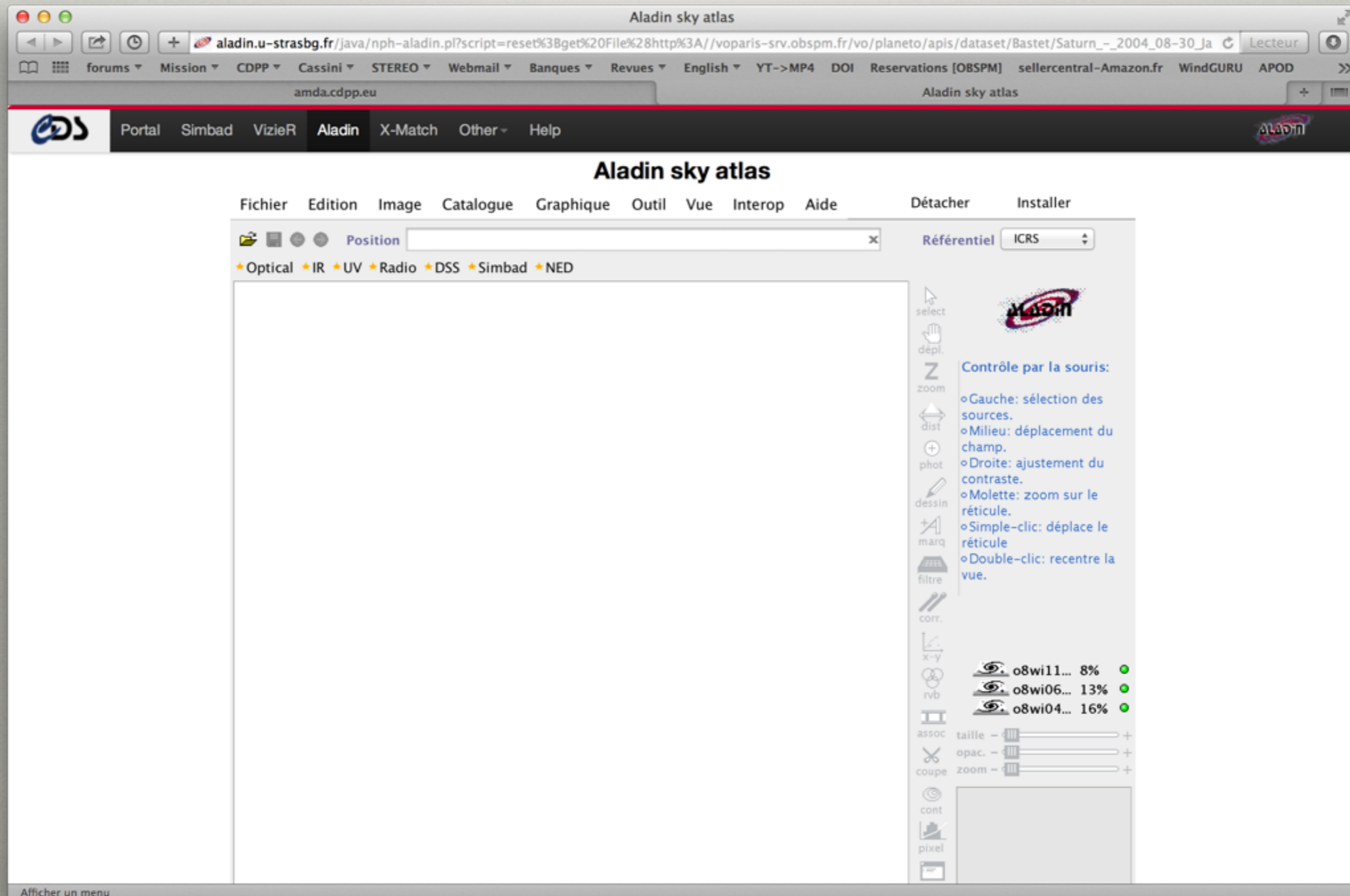
- Request definition:** Target: Saturn; Start Time: 2004/01/13 00:00; Stop Time: 2004/01/31 00:00; Duration: 0018 00 00 00; Delta T: 0 minute(s).
- Image Selection:** A list of image files is shown, including folders for 2004-01-24 (4 images), 2004-01-25 (2 images), and 2004-01-26 (6 images). The file "2004-01-26 18:44:52 - Original data" is selected.
- Interoperability:** A "Send to Aladin Web" button is visible, which is the focus of the caption.

The interface also features a "Workspace Explorer" on the left, a "Log" panel at the bottom left, and a "Plot" panel on the right showing a spectral density plot. The bottom status bar indicates the current time as 10:01 AM.

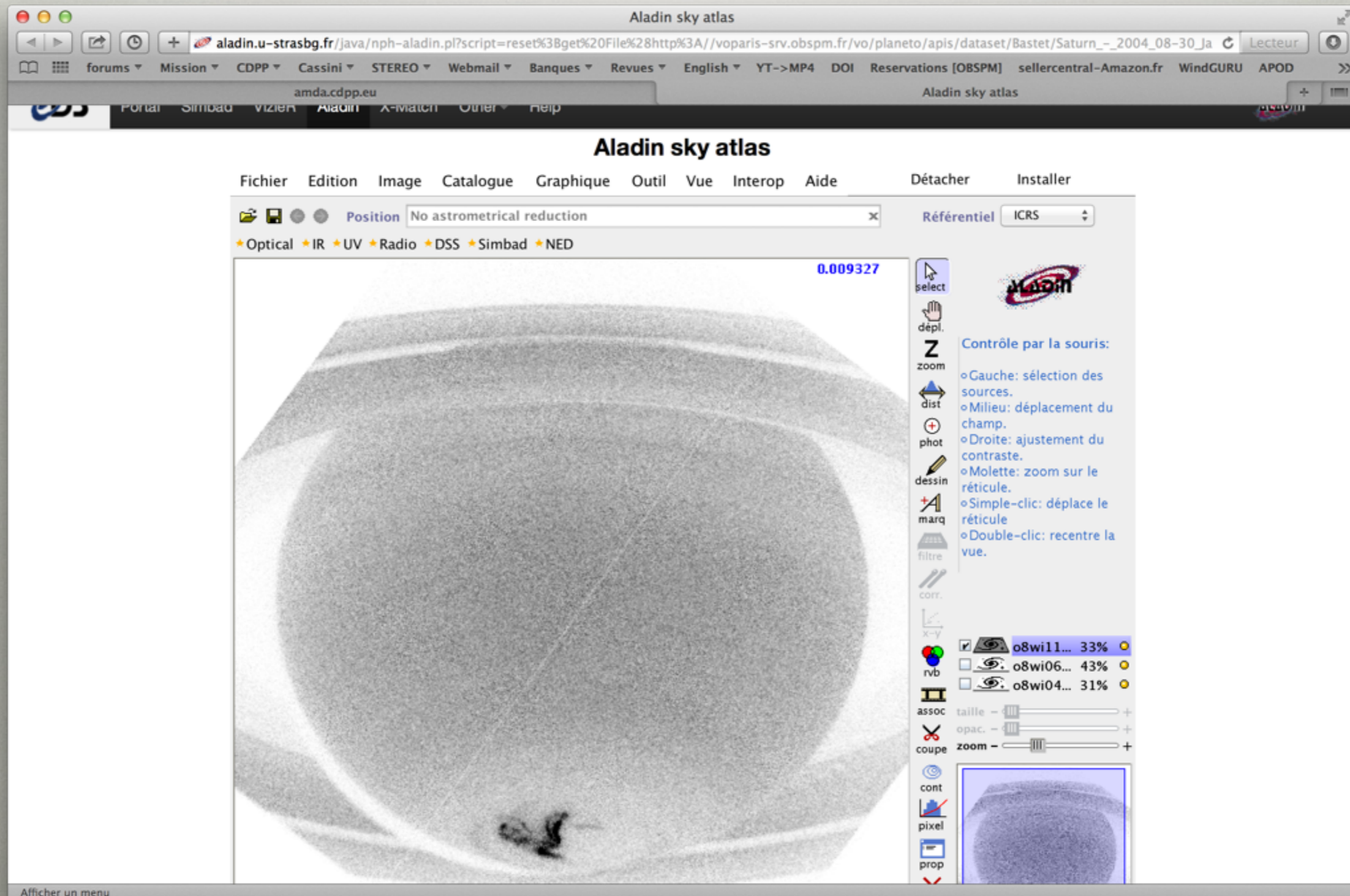
Send selected data to Aladin (IVOA image viewer)

# EXAMPLE 1:

# AURORAL PHYSICS AT SATURN



# EXAMPLE 1: AURORAL PHYSICS AT SATURN

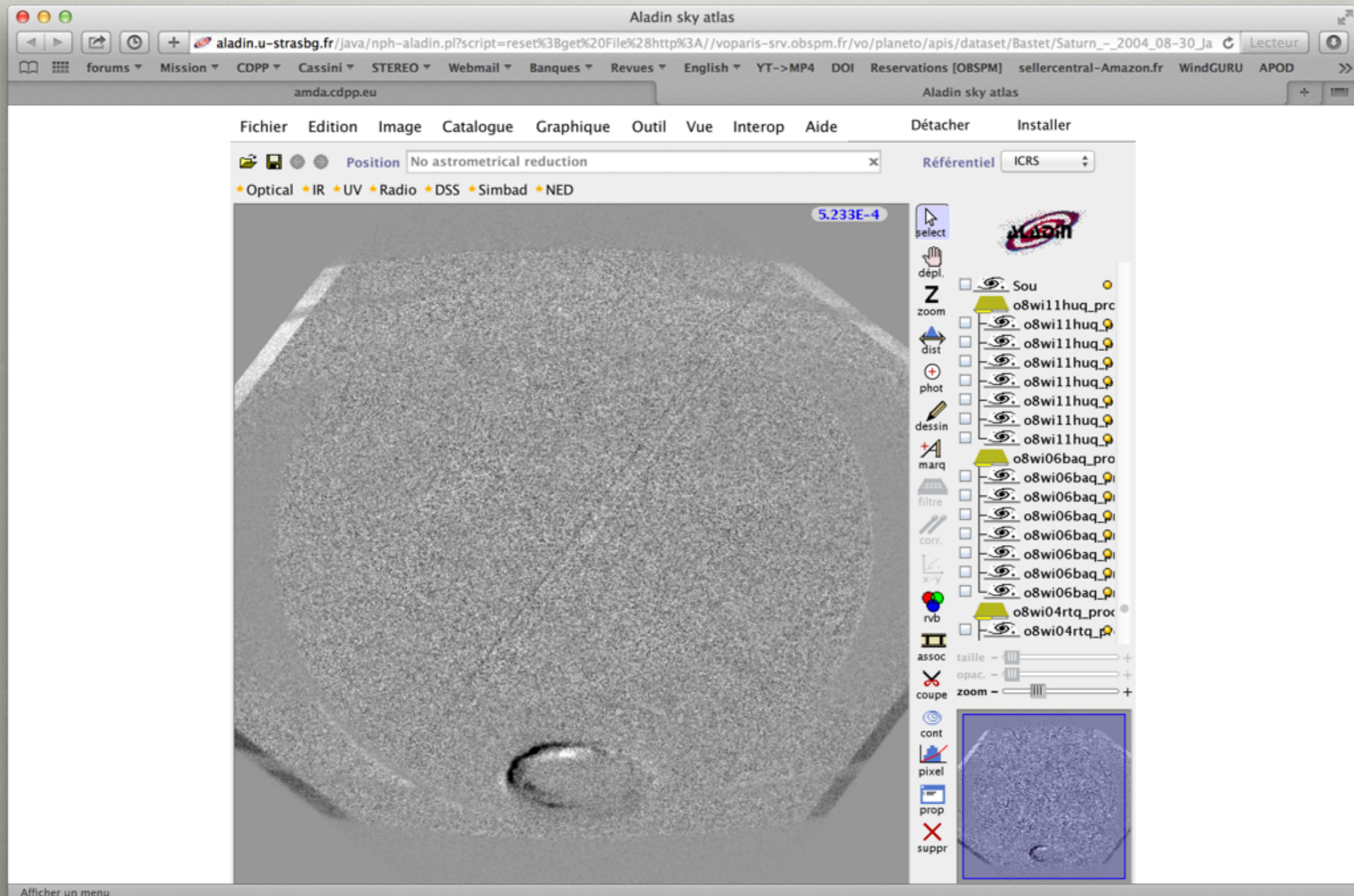


Data are loaded into Aladin from their URL in APIS



# EXAMPLE 1:

# AURORAL PHYSICS AT SATURN



Basic operations: here image subtraction

# EXAMPLE 2: SOLAR WIND AT MARS

The screenshot displays the AMDA (Automatic Multi-Dimensional Data Analysis) software interface. On the left, the 'Workspace Explorer' shows a hierarchical tree of data resources, including folders for 'VEX', 'MEX', 'ephemeris', 'orbit', 'IMA', and 'MARSIS'. The 'MARSIS' folder is expanded, showing various data parameters like 'v\_mso\_protons', 'v\_mso\_heavy', and 'moments\_quality\_protons'. On the right, the 'Plot' window is active, showing a configuration for five panels. Each panel is set to 'TIME' plot type with a height of 0.4 and width of 1. The 'Time Selection' section is configured for an interval from 2007/07/12 00:00 to 2007/07/12 10:00. The 'Plot File Name' is empty, 'Char Size' is 1.3, 'Orientation' is LANDSCAPE, 'File Format' is PNG, and 'Points per Plot' is 3000. The 'Request Name' is 'Mars\_lathys\_demo'. Below the plot configuration, there is an 'Information' section with instructions on how to use the software.

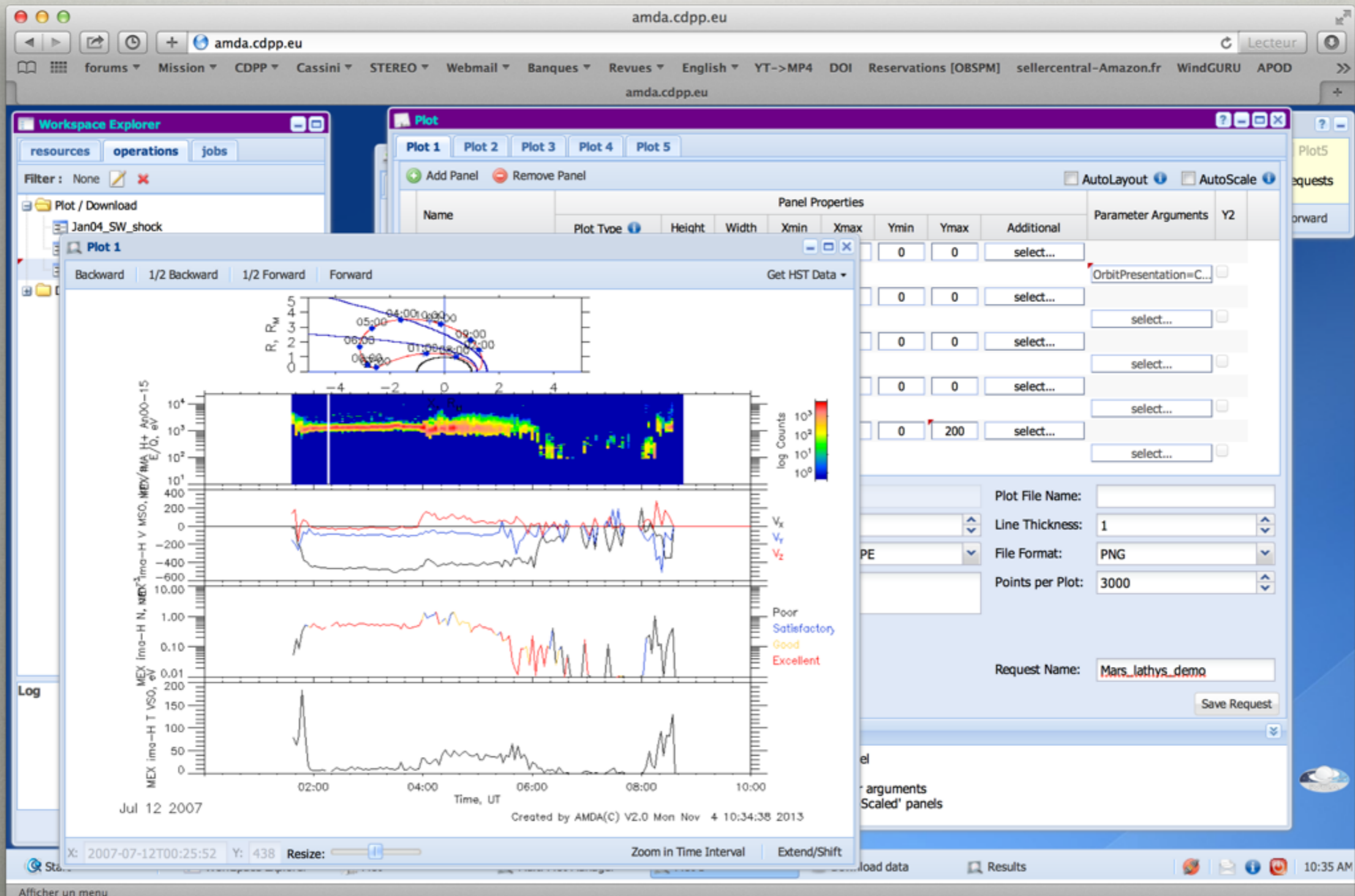
Name	Plot Type	Height	Width	Xmin	Xmax	Ymin	Ymax	Additional	Parameter Arguments	Y2
Panel 1	TIME	0.4	1	0	0	0	0	select...		
mex_xyz									OrbitPresentation=C...	
Panel 2	TIME	0.4	1	0	0	0	0	select...		
mex_h_spec									select...	
Panel 3	TIME	0.4	1	0	0	0	0	select...		
mex_h_vel									select...	
Panel 4	TIME	0.4	1	0	0	0	0	select...		
mex_h_dens									select...	
Panel 5	TIME	0.4	1	0	0	0	0	select...		
mex_o_temp									select...	

**Information**

1. To plot a parameter, **drag** it from the Parameters tree and **drop** onto the panel
2. Y2-axis option is not implemented yet
3. XY ('Scatter') PlotType takes into account only 'Symbol' and 'Color' parameter arguments
4. If AutoScale mode is selected AMDA ignores all parameter arguments for 'AutoScaled' panels

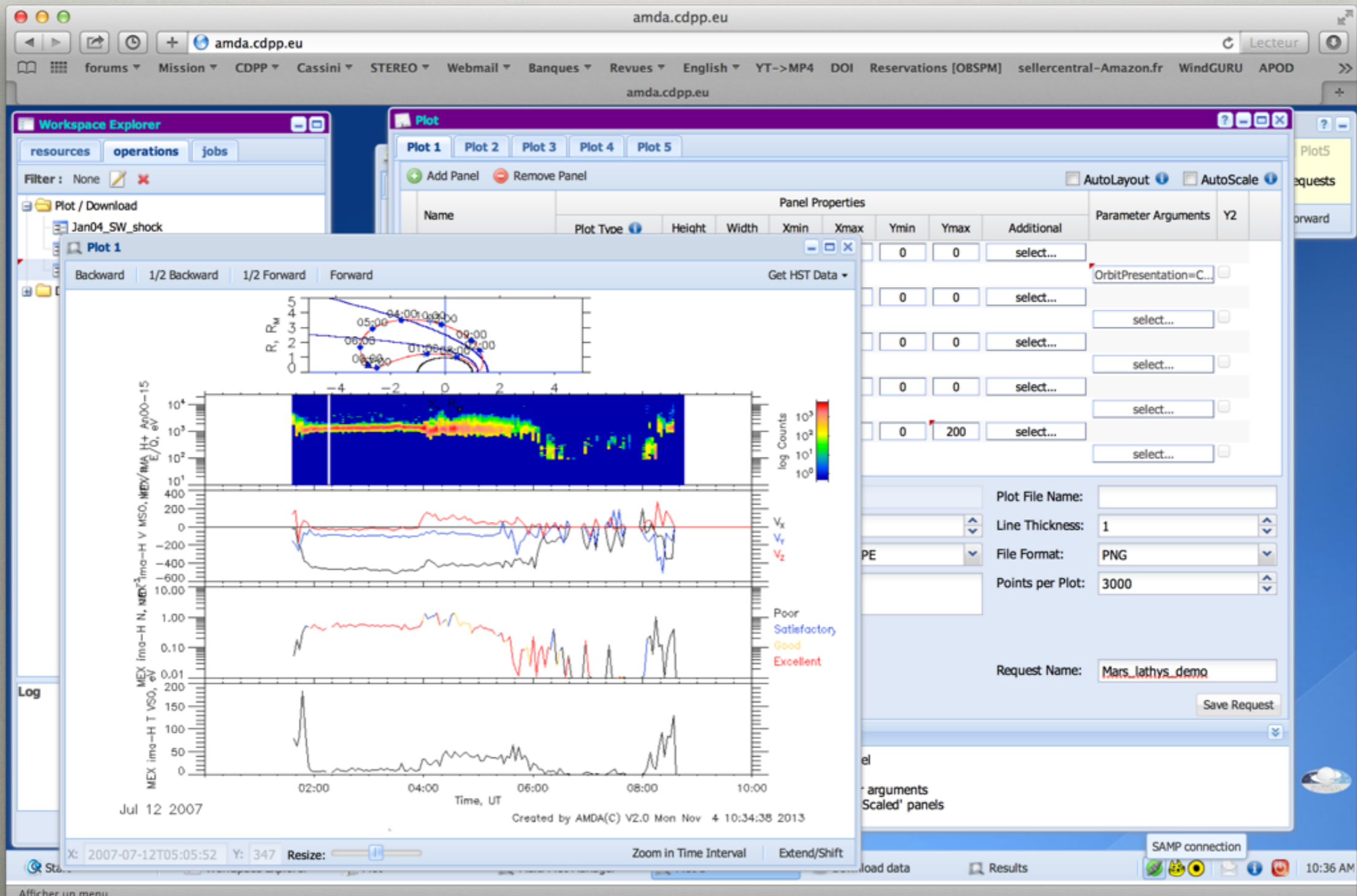
Mars Express data in AMDA on day 2007/07/12

# EXAMPLE 2: SOLAR WIND AT MARS



Plot results

# EXAMPLE 2: SOLAR WIND AT MARS



Connecting AMDA to TOPCAT (IVOA Table Data tool) with SAMP

# EXAMPLE 2: SOLAR WIND AT MARS

The screenshot displays the amda.cdpp.eu web interface. A 'Download data' dialog box is open, showing the following configuration:

- Request Name: Mars\_lathys\_demo
- Time Format: YYYY-MM-DDThh:mm:ss
- Show Milliseconds:
- File Structure: All In One File
- Sampling Time: 60
- File Name: (empty)
- Header: Write Into Data File
- File Format: ASCII
- Compression: tar+gzip
- Time Selection:  Interval
- Start Time: 2007/07/12 00:00
- Stop Time: 2007/07/12 10:00
- Duration: 0000 10 00 00

The background plot shows several time-series data series for solar wind parameters at Mars. The x-axis represents time on July 12, 2007, with a zoomed-in interval from 02:00 to 04:00. The y-axis represents various parameters including velocity (V), density (dens), and temperature (temp). The plot shows a significant increase in these parameters around 03:00, corresponding to a solar wind event.

**Information**

1. To download a parameter / time table, **drag** it from the Parameters / Time Tables tree and **drop** onto the corresponding panel.
2. To download data for a time table intervals select Time Table in the Time Selection area and drag/drop there the time table.
2. YZ-axis option is not implemented yet
3. XY ('Scatter') PlotType takes into account only 'Symbol' and 'Color' parameter arguments
4. If AutoScale mode is selected AMDA ignores all parameter arguments for 'AutoScaled' panels

Preparing data transfer to TOPCAT

# EXAMPLE 2: SOLAR WIND AT MARS

The screenshot displays the AMDA (Automatic Mission Data Analysis) web interface. The main window shows a workspace with a plot of solar wind data at Mars. The plot displays several parameters over time, including  $R_p$ ,  $R_M$ , and various ion fluxes. A 'Download data' dialog box is open, showing the 'Get Data' tab. The 'Request Name' is 'Mars\_lathys\_demo'. The 'Time Format' is 'YYYY-MM-DDThh:mm:ss'. The 'File Structure' is 'All In One File' and the 'Sampling Time' is 60. The 'Results' sub-dialog is open, showing two data results: 'result\_493650' and 'result\_492842'. The 'Send (via SAMP) to ...' dropdown menu is open, showing 'topcat (c1)' and 'all clients (hub)' as options. The 'Information' section at the bottom of the dialog provides instructions for downloading data and time tables.

**Download data**

Get Data | Get Time Table

Request Name: Mars\_lathys\_demo | Time Format: YYYY-MM-DDThh:mm:ss

Show Milliseconds:

File Structure: All In One File | Sampling Time: 60

**Results**

Download Results

result\_493650  
File: Download | Delete | Send (via SAMP) to ...

result\_492842  
File: Download | Delete | Send (via SAMP) to ...

topcat (c1)  
all clients (hub)

**Information**

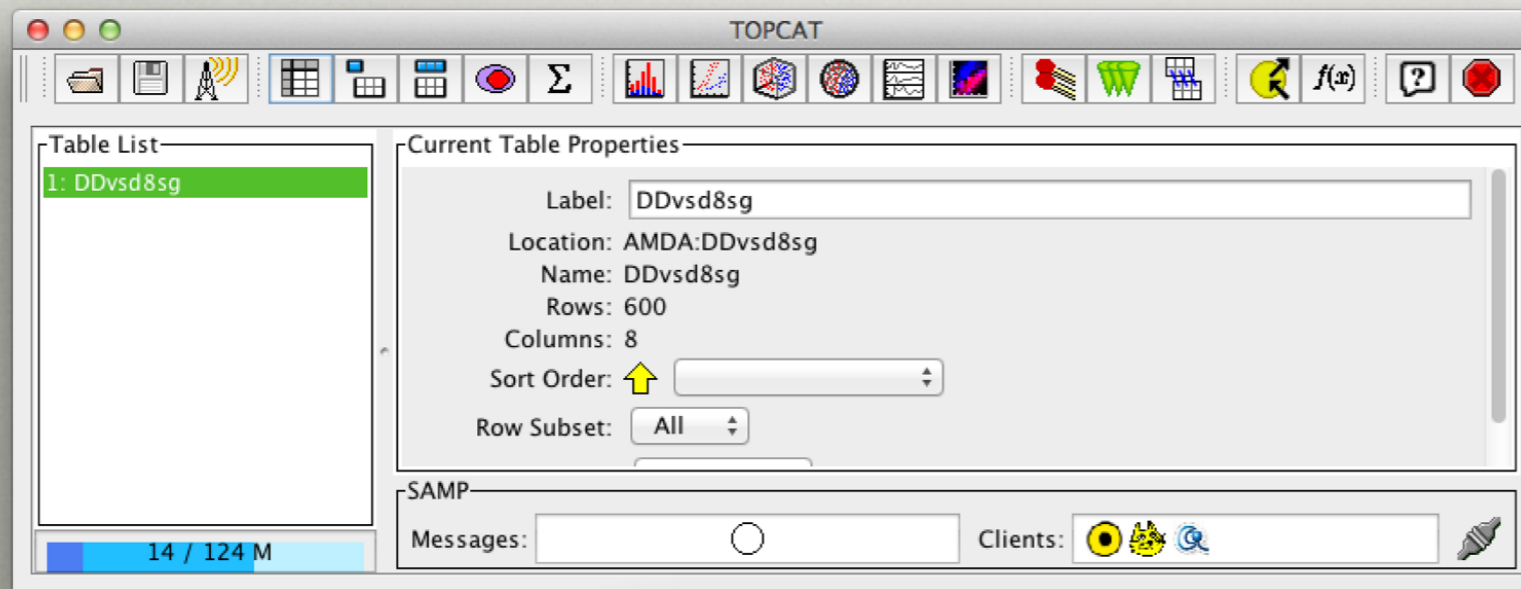
1. To download a parameter / time table, **drag** it from the Parameters / Time Tables tree and **drop** onto the corresponding panel.
2. To download data for a time table intervals select Time Table in the Time Selection area and drag/drop there the time table.
2. YZ-axis option is not implemented yet
3. XY ('Scatter') PlotType takes into account only 'Symbol' and 'Color' parameter arguments
4. If AutoScale mode is selected AMDA ignores all parameter arguments for 'AutoScaled' panels

Download | Reset

Request Name: Mars\_lathys\_demo | Save Request

Sending data to TOPCAT

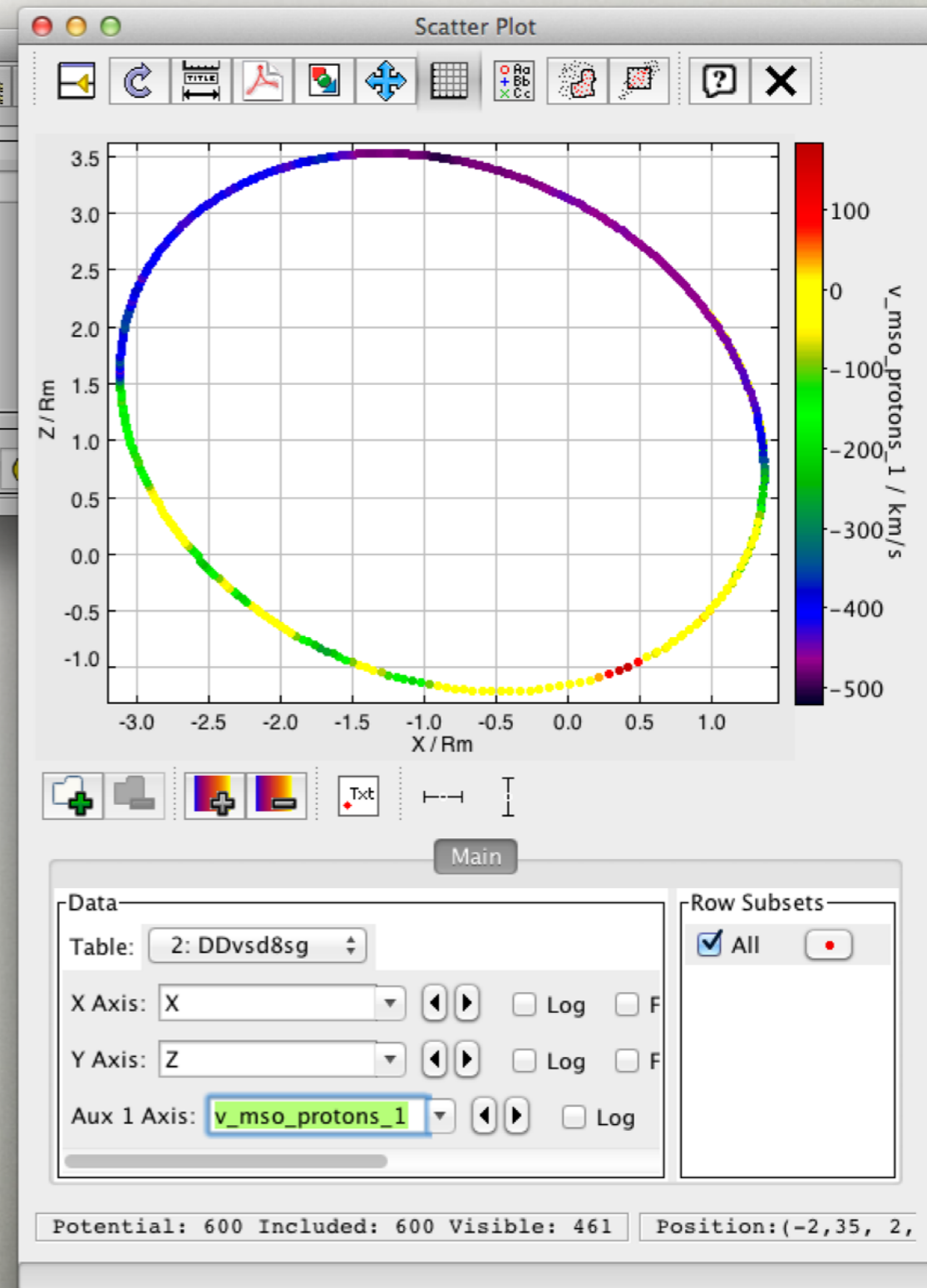
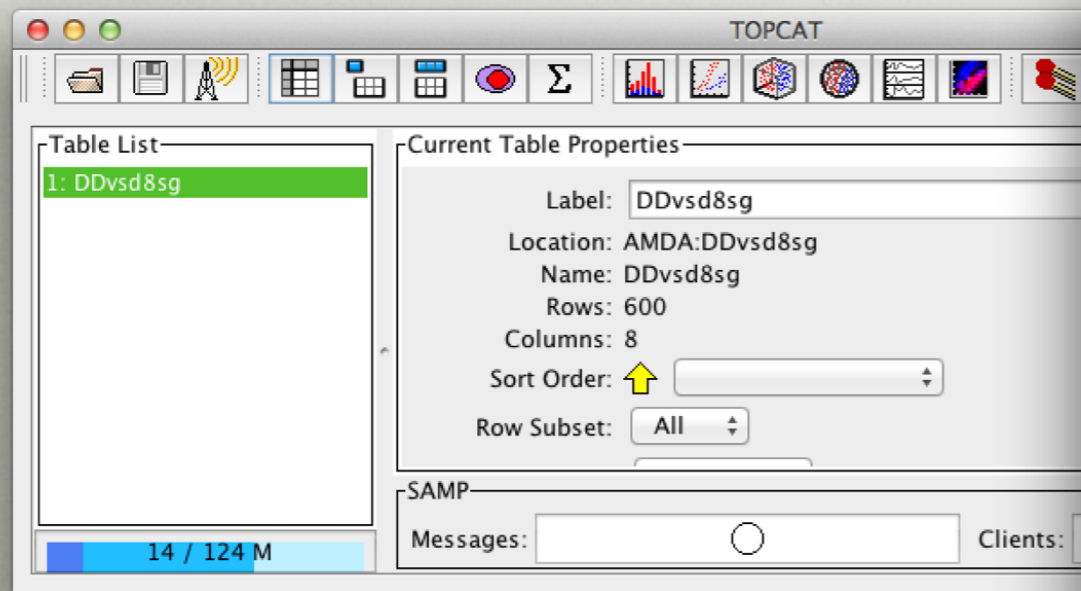
# EXAMPLE 2: SOLAR WIND AT MARS



The screenshot shows the 'TOPCAT(1): Table Browser' window. The table displayed is titled 'Table Browser for 1: DDvsd8sg' and contains the following data:

	Time	X	Y	Z	v_mso_protons
116	2007-07-12T01:55:30.000Z	1,31764	-0,064094	1,20108	(-422.996, -30.7183, 3.008
117	2007-07-12T01:56:30.000Z	1,30697	-0,060135	1,25268	(-432.457, -42.8213, -2.40
118	2007-07-12T01:57:30.000Z	1,29531	-0,056097	1,30398	(-441.918, -54.9243, -7.82
119	2007-07-12T01:58:30.000Z	1,28296	-0,052063	1,35394	(-451.184, -66.9892, -13.1
120	2007-07-12T01:59:30.000Z	1,26969	-0,047957	1,40358	(-447.326, -76.5052, -14.3
121	2007-07-12T02:00:30.000Z	1,25583	-0,043864	1,45192	(-443.468, -86.0212, -15.5
122	2007-07-12T02:01:30.000Z	1,24113	-0,039705	1,49993	(-439.611, -95.5372, -16.7
123	2007-07-12T02:02:30.000Z	1,22592	-0,035567	1,54667	(-441.679, -91.5097, -18.8
124	2007-07-12T02:03:30.000Z	1,20989	-0,031359	1,59318	(-445.094, -84.4017, -21.1
125	2007-07-12T02:04:30.000Z	1,19329	-0,027145	1,6388	(-448.51, -77.2938, -23.45
126	2007-07-12T02:05:30.000Z	1,17631	-0,02296	1,6832	(-450.644, -79.6453, -22.4
127	2007-07-12T02:06:30.000Z	1,15861	-0,018722	1,72728	(-451.975, -87.9136, -19.3
128	2007-07-12T02:07:30.000Z	1,14058	-0,014519	1,77016	(-453.307, -96.1819, -16.2
129	2007-07-12T02:08:30.000Z	1,12189	-0,010266	1,81273	(-454.811, -99.6504, -14.4
130	2007-07-12T02:09:30.000Z	1,10294	-0,006051	1,85414	(-456.56, -96.3142, -14.35

# EXAMPLE 2: SOLAR WIND AT MARS



plotting data in TOPCAT



# EXAMPLE 2: SOLAR WIND AT MARS

The screenshot displays the LatHyS web interface in a browser window. The address bar shows the URL `impex.latmos.ipsl.fr/LatHyS.htm`. The page features a navigation menu with links for 'forums', 'Mission', 'CDPP', 'Cassini', 'STEREO', 'Webmail', 'Banques', 'Revues', 'English', 'YT->MP4', 'DOI', 'Reservations [OBSPM]', 'sellercentral-Amazon.fr', 'WindGURU', and 'APOD'. The main content area is divided into several sections:

- Data tree:** A hierarchical tree structure on the left side, including folders for 'Mars', 'Simulations', '3DCubes', 'TimeSeries', '2DCuts', 'IonComposition', 'ElectricField', 'Current', 'MagneticField', 'ThermalPlasma', 'Plasma/2D/XY', 'Plasma/2D/XZ', 'Plasma/2D/YZ', 'ElectronDensity', 'PlasmaBulk VelocityNorm', 'PlasmaBulk VelocityVector', 'PlasmaBulk Temperature', 'Spacecraft', and 'Saturn'. A 'Filter:' input field is located below the tree.
- About LatHyS** and **Use policy** links are positioned at the top center.
- Data Information:** Displays 'Plasma/2D/XZ' as the selected data.
- Product Type:** 2DCuts  
**MeasurementType:** ThermalPlasma
- Contents:** A list of data variables: ElectronDensity, PlasmaBulk VelocityNorm, PlasmaBulk VelocityVector, and PlasmaBulk Temperature. A 'Download' button and a 'Send' icon are also present.
- Run Information:** Shows 'LatHyS\_Mars\_13\_02\_13' as the run name.
- Simulated Region:** Mars  
**Reference Frame:** MSO, Cartesian
- Domain:** x $\in$ [-8167.9,8385.7] km, y $\in$ [-15882.1,15932.0] km, z $\in$ [-15995.5,16077.2] km
- Cell size:** 129.3 129.3 129.3 km  
**Sub Solar Longitude:** 0.00°
- Solar wind properties:** IMF value: 3.001 nT, IMF cone angle: 57.10°, IMF: (1.63,-2.52,0.00) nT, Density: 4.21E+00 cm<sup>-3</sup>, Velocity: 400.00 km\*s<sup>-1</sup>, Density: 4.00E+00 cm<sup>-3</sup>, Velocity: 400.00 km\*s<sup>-1</sup>, Density: 2.11E-01 cm<sup>-3</sup>, Velocity: 400.00 km\*s<sup>-1</sup>, Solar UV Flux @ 10.7: 240.00
- Solar wind populations:** Name: Solar Wind electrons, Name: Solar Wind H, Name: Solar Wind He
- Ionosphere populations:** Name: Ionospheric electrons, Name: Ionospheric CO2+, Name: Ionospheric O+, Name: Ionospheric H+, Name: Ionospheric O2+
- Exosphere populations:** Name: Exospheric O, Name: Exospheric CO2, Name: Exospheric H

The footer of the page includes the text 'Afficher un menu'.

# EXAMPLE 2: SOLAR WIND AT MARS

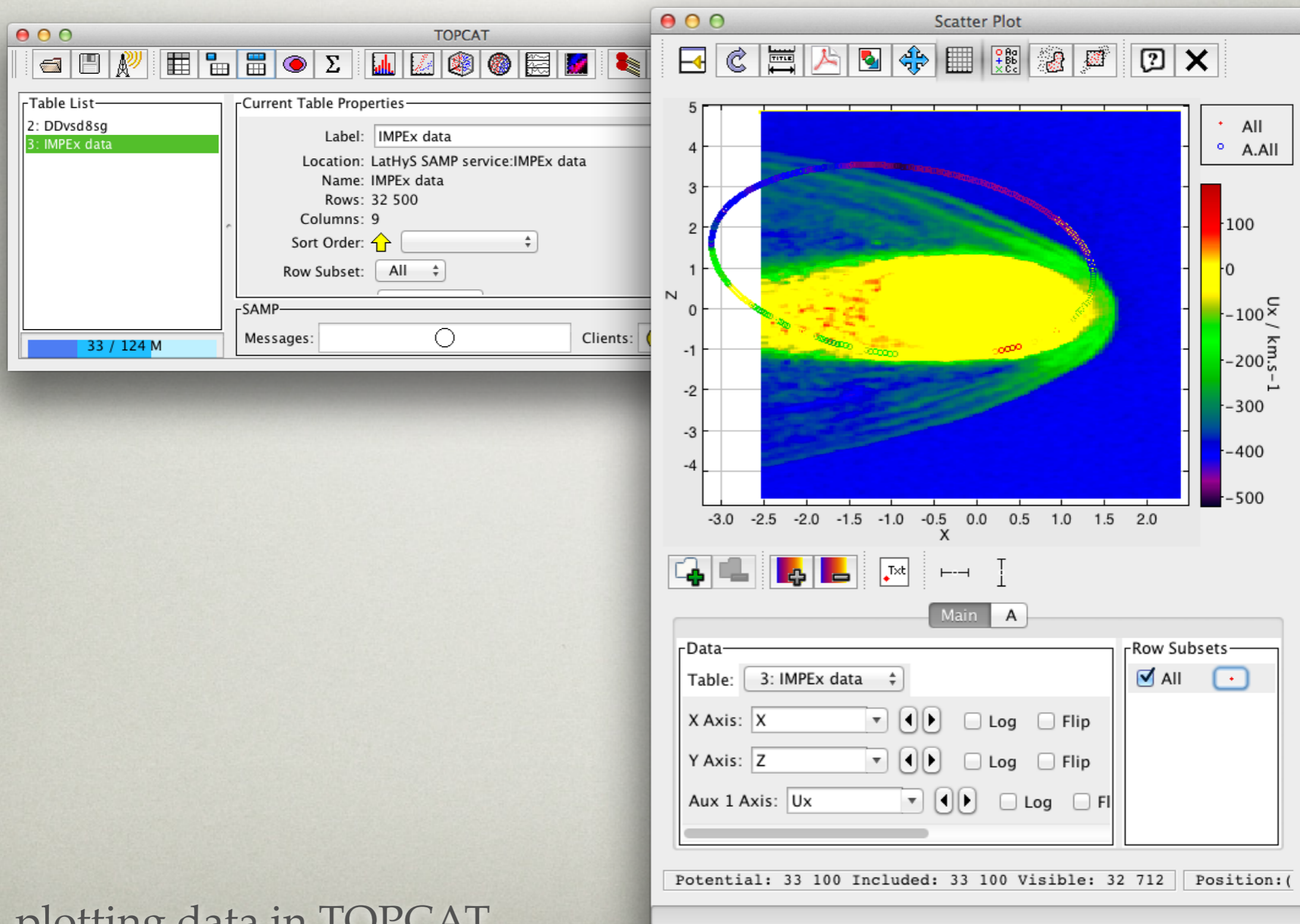
The screenshot displays the LatHyS web interface. The browser address bar shows `impex.latmos.ipsl.fr/LatHyS.htm`. The page features a navigation menu with items like 'forums', 'Mission', 'CDPP', 'Cassini', 'STEREO', 'Webmail', 'Banques', 'Revues', 'English', 'YT->MP4', 'DOI', 'Reservations [OBSPM]', 'sellercentral-Amazon.fr', 'WindGURU', and 'APOD'. The main content area is divided into several sections:

- Data tree:** A hierarchical view of the simulation data, including folders for 'Mars', 'Simulations', '3DCubes', 'TimeSeries', '2DCuts', 'IonComposition', 'ElectricField', 'Current', 'MagneticField', 'ThermalPlasma', 'Plasma/2D/XY', 'Plasma/2D/XZ', 'Plasma/2D/YZ', 'ElectronDensity', 'PlasmaBulkVelocityNorm', 'PlasmaBulkVelocityVector', 'PlasmaBulkTemperature', 'Spacecraft', and 'Saturn'. A 'Filter:' input field is located below the tree.
- About LatHyS** and **Use policy** links.
- Data Information:** *Plasma/2D/XZ*
- Product Type:** 2DCuts  
**MeasurementType:** ThermalPlasma
- Contents:** A list of data variables: ElectronDensity, PlasmaBulkVelocityNorm, PlasmaBulkVelocityVector, and PlasmaBulkTemperature. Below this list are 'Download' and 'Send' buttons.
- Run Information:** *LatHyS\_Mars\_13\_02\_13*
- Simulated Region:** Mars  
**Reference Frame:** MSO, Cartesian
- Domain:**  $x \in [-8167.9, 8385.7]$  km,  $y \in [-15882.1, 15932.0]$  km,  $z \in [-15995.5, 16077.2]$  km
- Cell size:** 129.3 129.3 129.3 km  
**Sub Solar Longitude:** 0.00°
- Solar wind properties:**
  - IMF value:* 3.001 nT
  - IMF cone angle:* 57.10°
  - IMF:* (1.63,-2.52,0.00) nT
  - Density:* 4.21E+00 cm<sup>-3</sup>
  - Velocity:* 400.00 km\*s<sup>-1</sup>
  - Density:* 4.00E+00 cm<sup>-3</sup>
  - Velocity:* 400.00 km\*s<sup>-1</sup>
  - Density:* 2.11E-01 cm<sup>-3</sup>
  - Velocity:* 400.00 km\*s<sup>-1</sup>
  - Solar UV Flux @ 10.7:* 240.00
- Solar wind populations:**
  - Name: Solar Wind electrons
  - Name: Solar Wind H
  - Name: Solar Wind He
- Ionosphere populations:**
  - Name: Ionospheric electrons
  - Name: Ionospheric CO2+
  - Name: Ionospheric O+
  - Name: Ionospheric H+
  - Name: Ionospheric O2+
- Exosphere populations:**
  - Name: Exospheric O
  - Name: Exospheric CO2
  - Name: Exospheric H

The footer of the page contains the text 'Afficher un menu'.

Now connected to SAMP : click on send to show data in TOPCAT

# EXAMPLE 2: SOLAR WIND AT MARS



plotting data in TOPCAT