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*

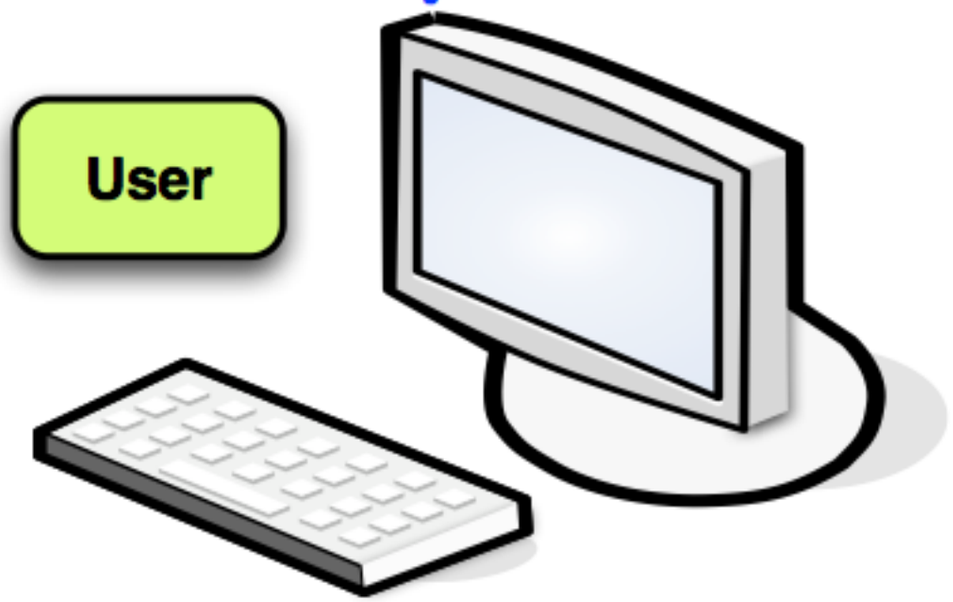
- IVOA: International Virtual Observatory Alliance *Astrophysics*
  http://ivoa.net

- SPASE: Space Physics Archive Search and Extract *Space Plasma*
  http://spase-group.org

- IPDA: International Planetary Data Alliance *Planetary Sci.*
  http://planetarydata.org *(agencies)*

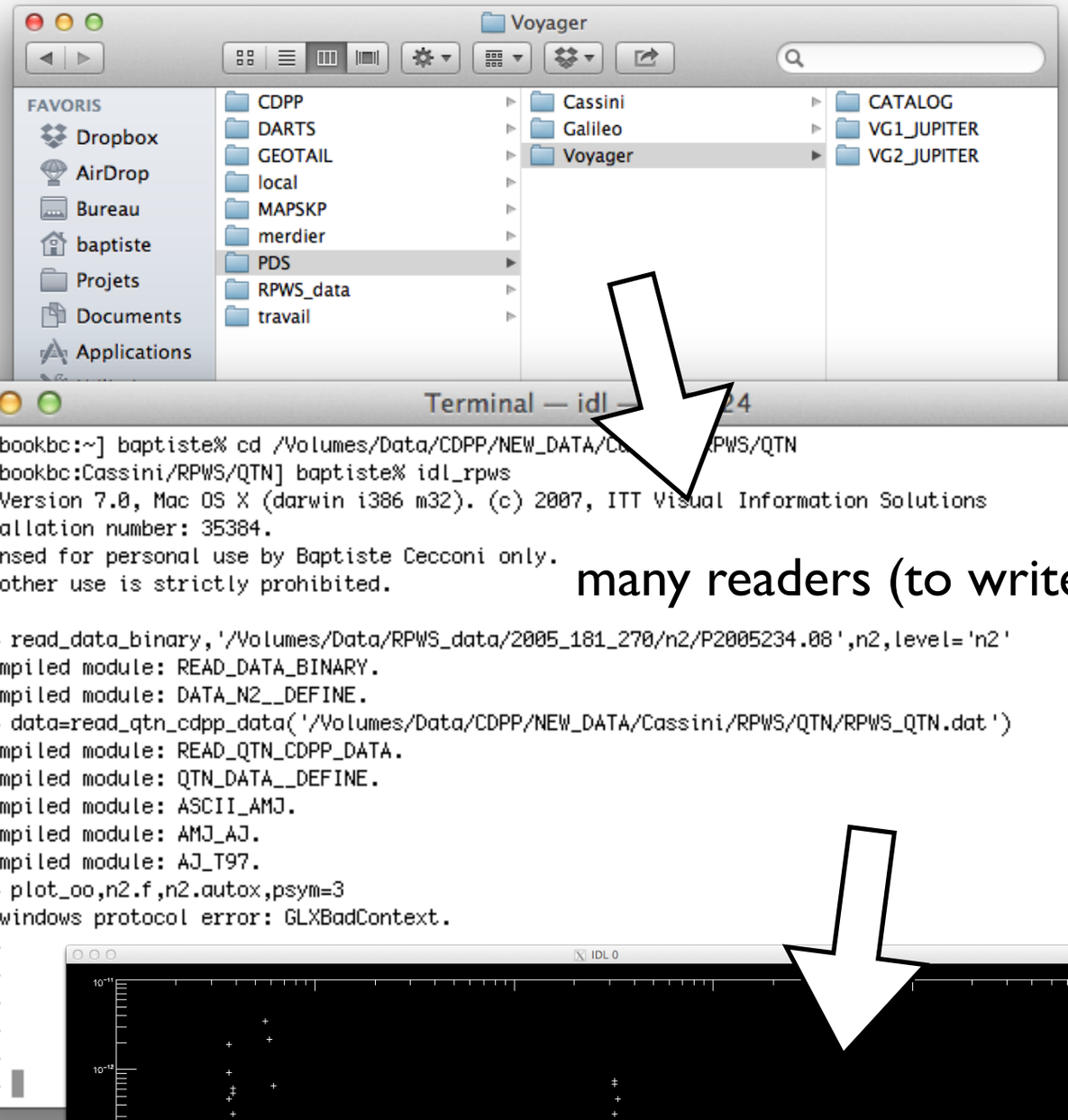
- OGC: Open Geospatial Consortium *Surface Sci. (mainly*
  http://www.opengeospatial.org *Earth)*

User's experience «classic»



Search Data
(many interfaces)

Get Data
(many formats)



many readers (to write!)

SSODnet

GhoSST
KIDA

PSA

AMDA…

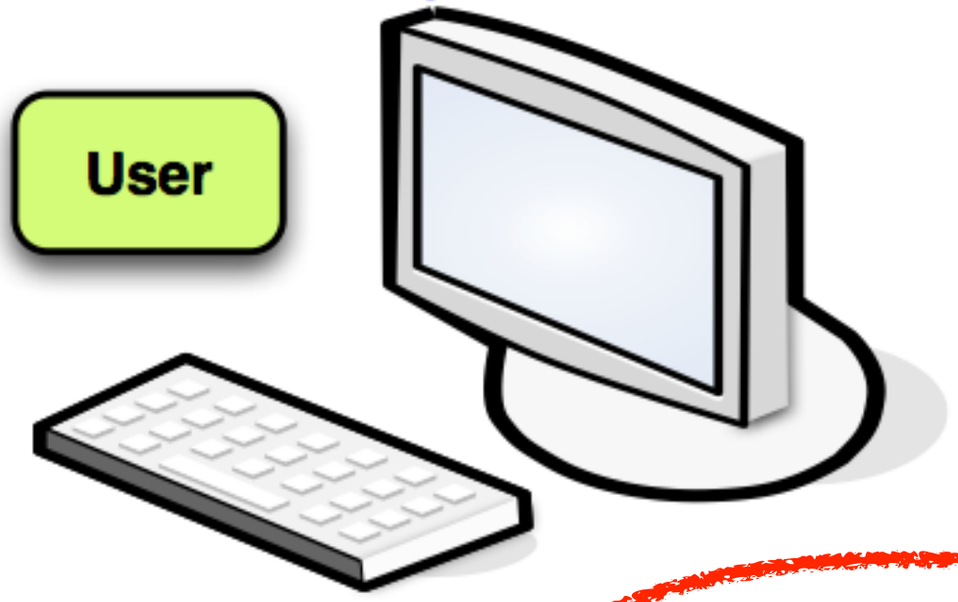
EPN

PDS

Data bases

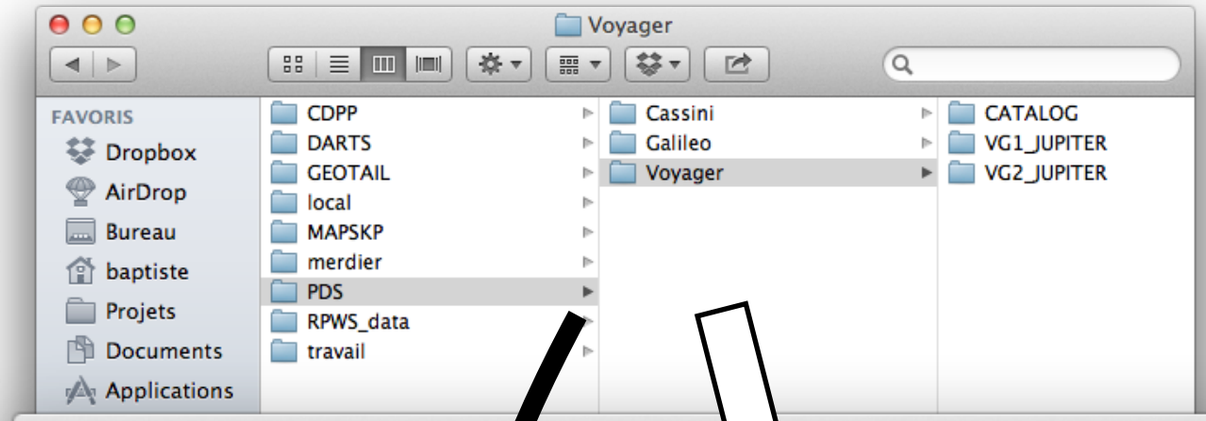
Space agency archives

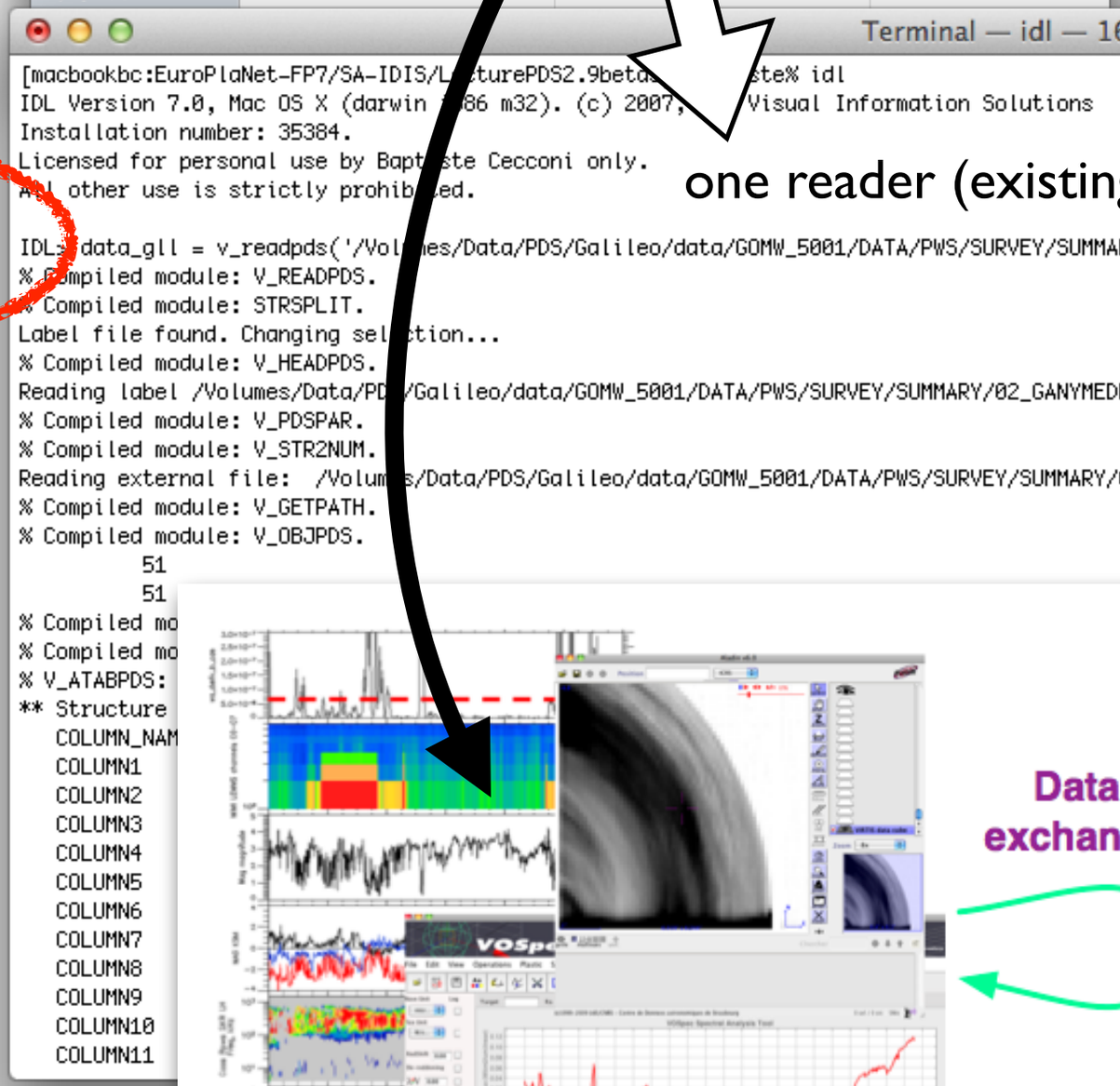
User's experience «enhanced»



Search Data
(many interfaces)

Get Data
(Standard format)
[VOTable...]





one reader (existing!)

SSODnet

GhoSST
KIDA

PSA

AMDA...

EPN

PDS

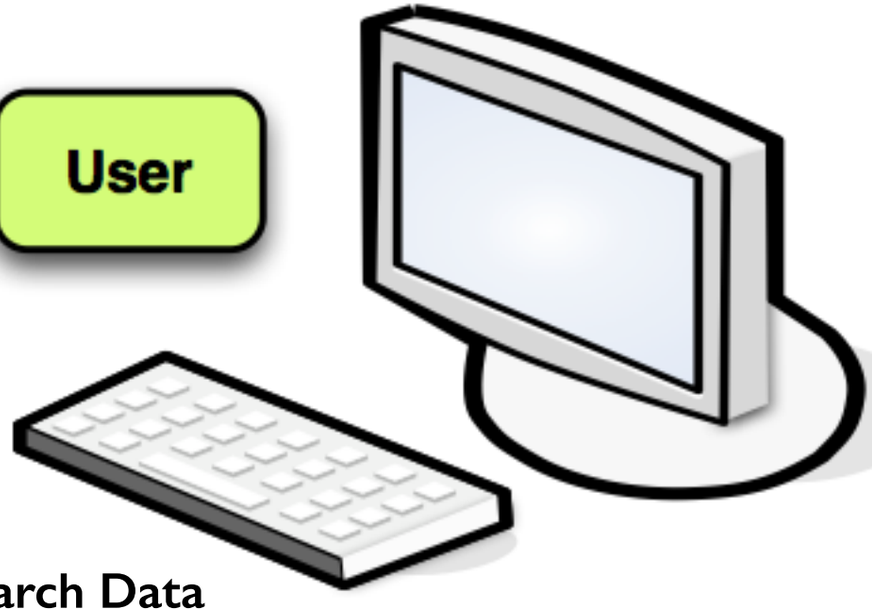
Data bases

Space agency archives

Data exchange

Visualization and other tools

User's experience «ultimate»



User

Search Data (one simple interface)

list of Result

form

VESPA

Standard Query

Standard Answer

Automated Data Access

Catalogue / Registry

SSODnet

GhoSST KIDA

PSA

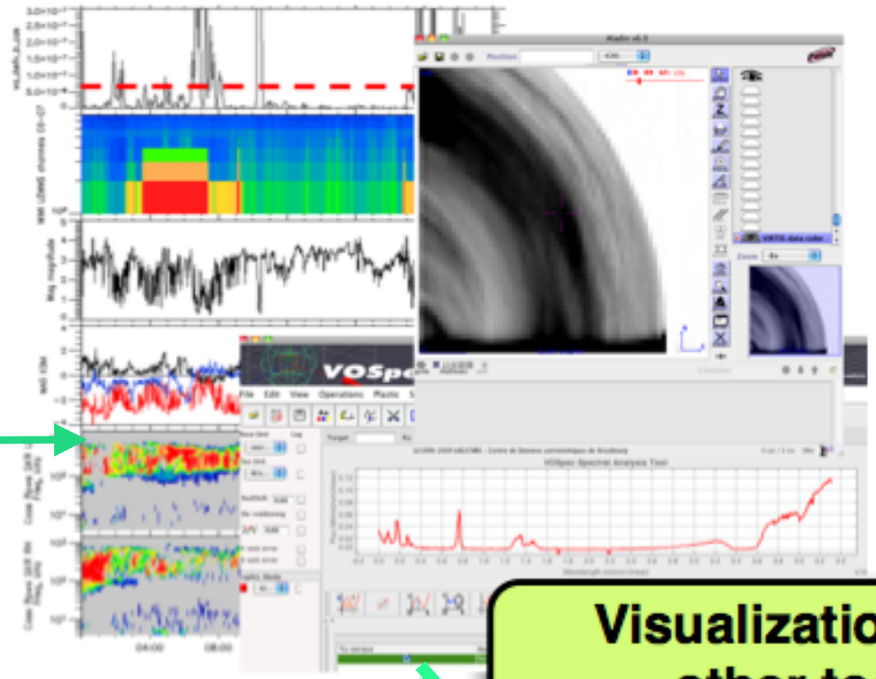
AMDA...

EPN

PDS

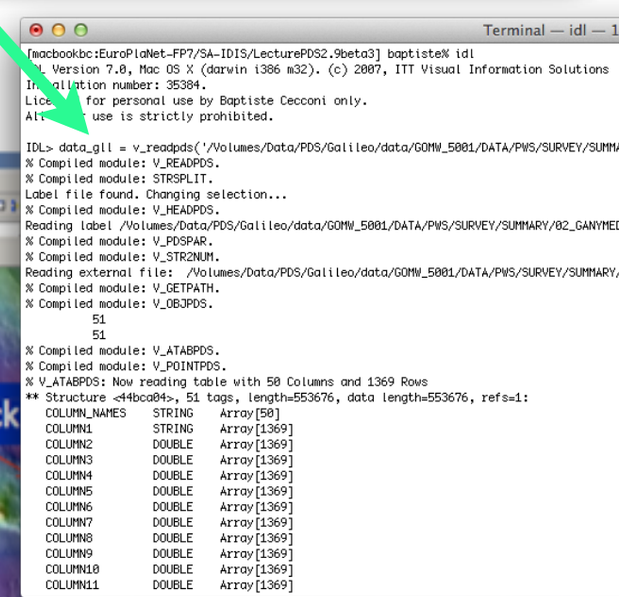
Data bases

Space agency archives



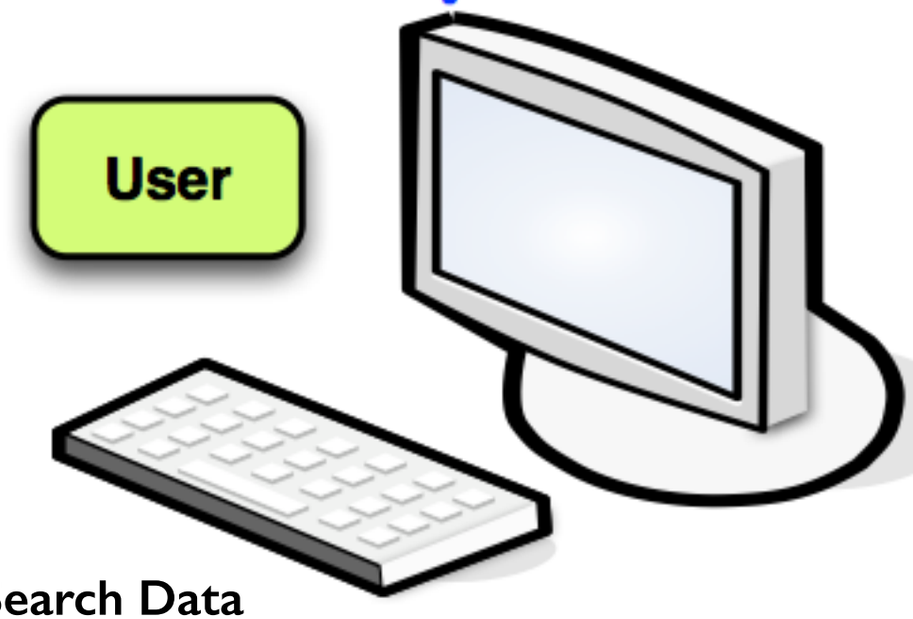
Data exchange

Visualization and other tools



Specialized tools, GIS

User's experience «ultimate»



User

Search Data (one simple interface)

list of Result

form

VESPA

Standard Query

Standard Answer

Automated Data Access

Catalogue / Registry

SSODnet

CheSST

IUGONET

PSA

DARTS

RadioJOVE

AMDA...

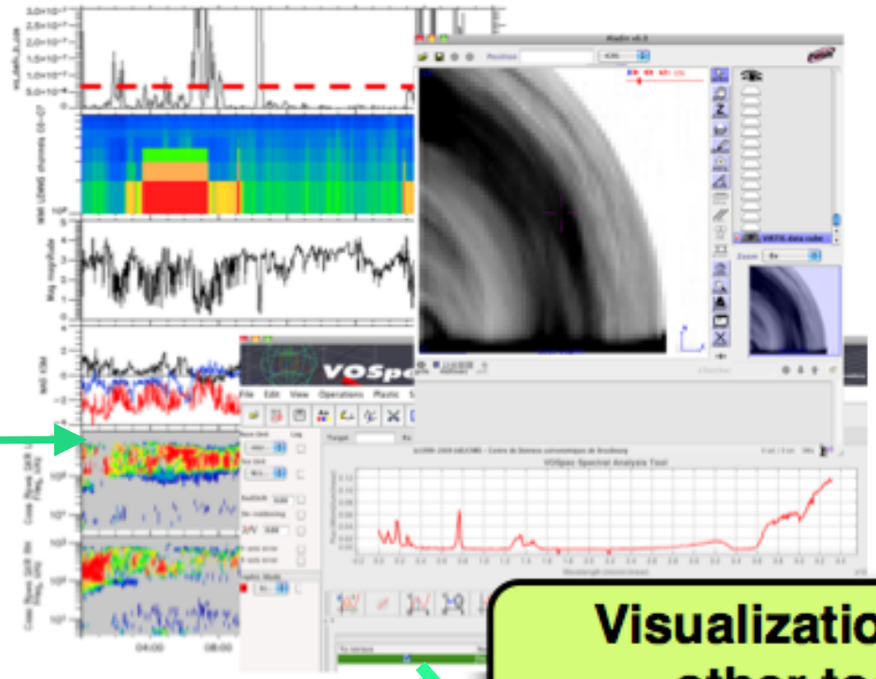
EPN

PDS

IMPEx

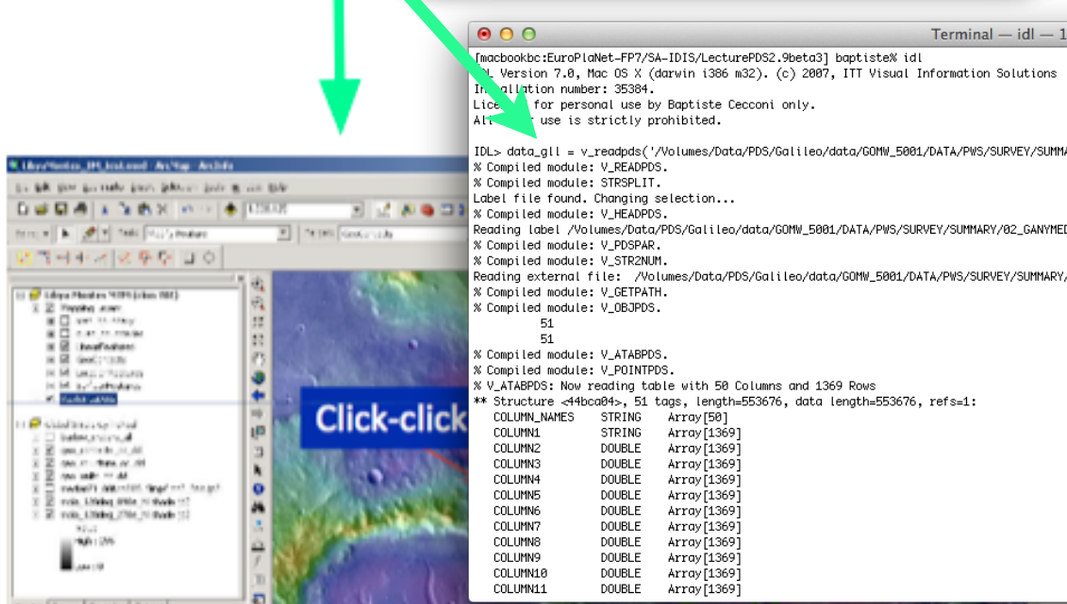
Data bases

Space agency archives



Data exchange

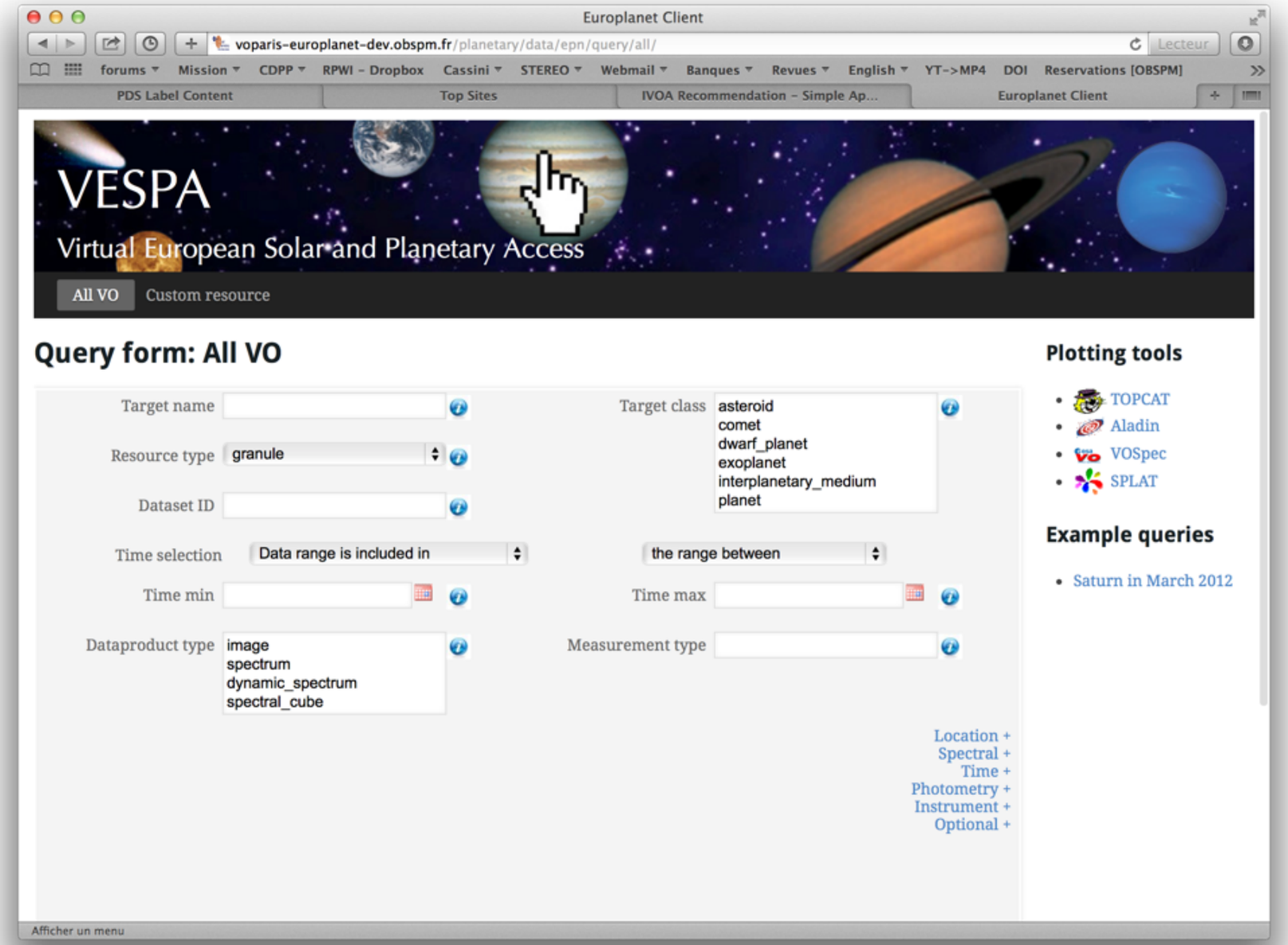
Visualization and other tools



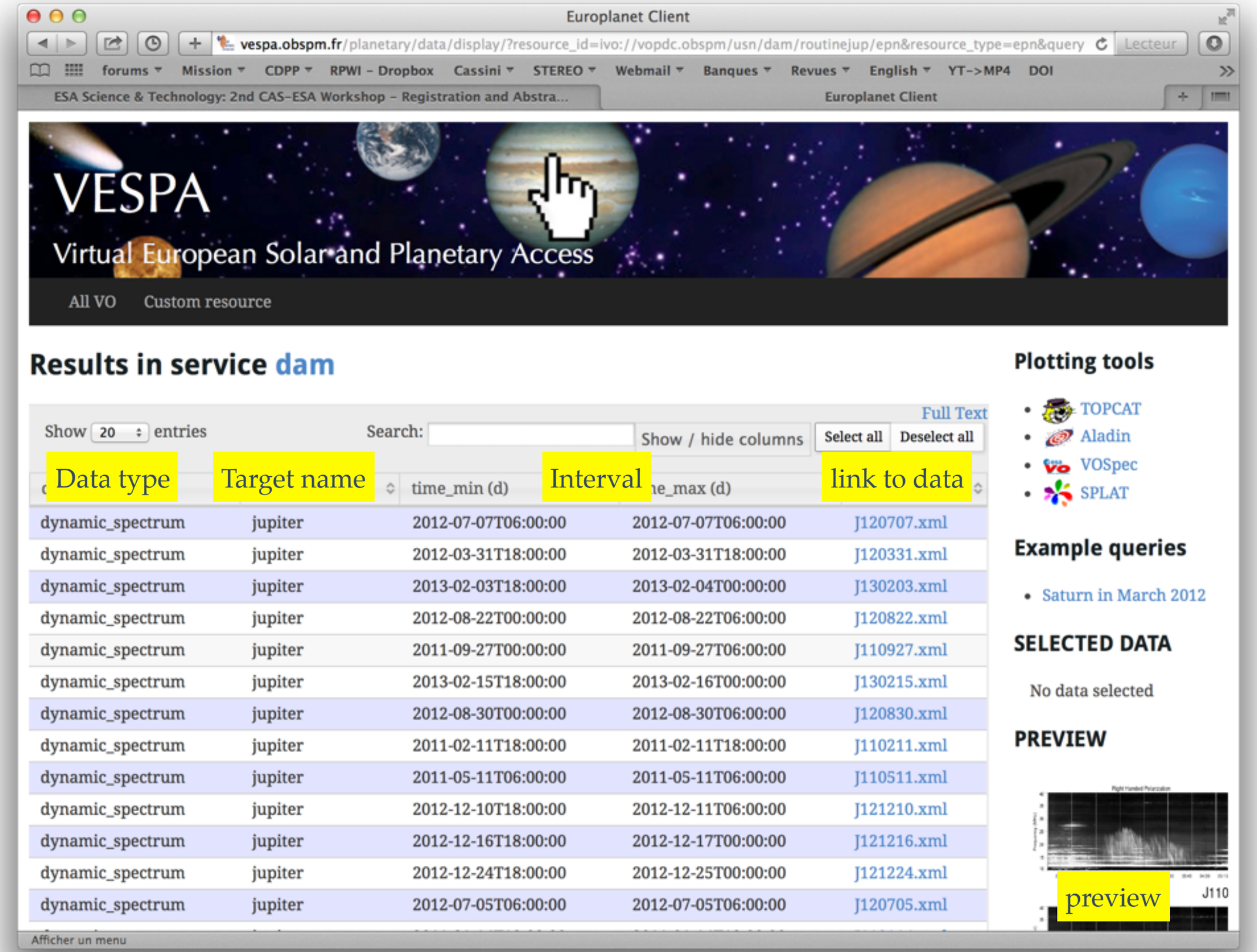
Specialized tools, GIS

VESPA Web Portal

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



Result page: search for Jupiter data



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.

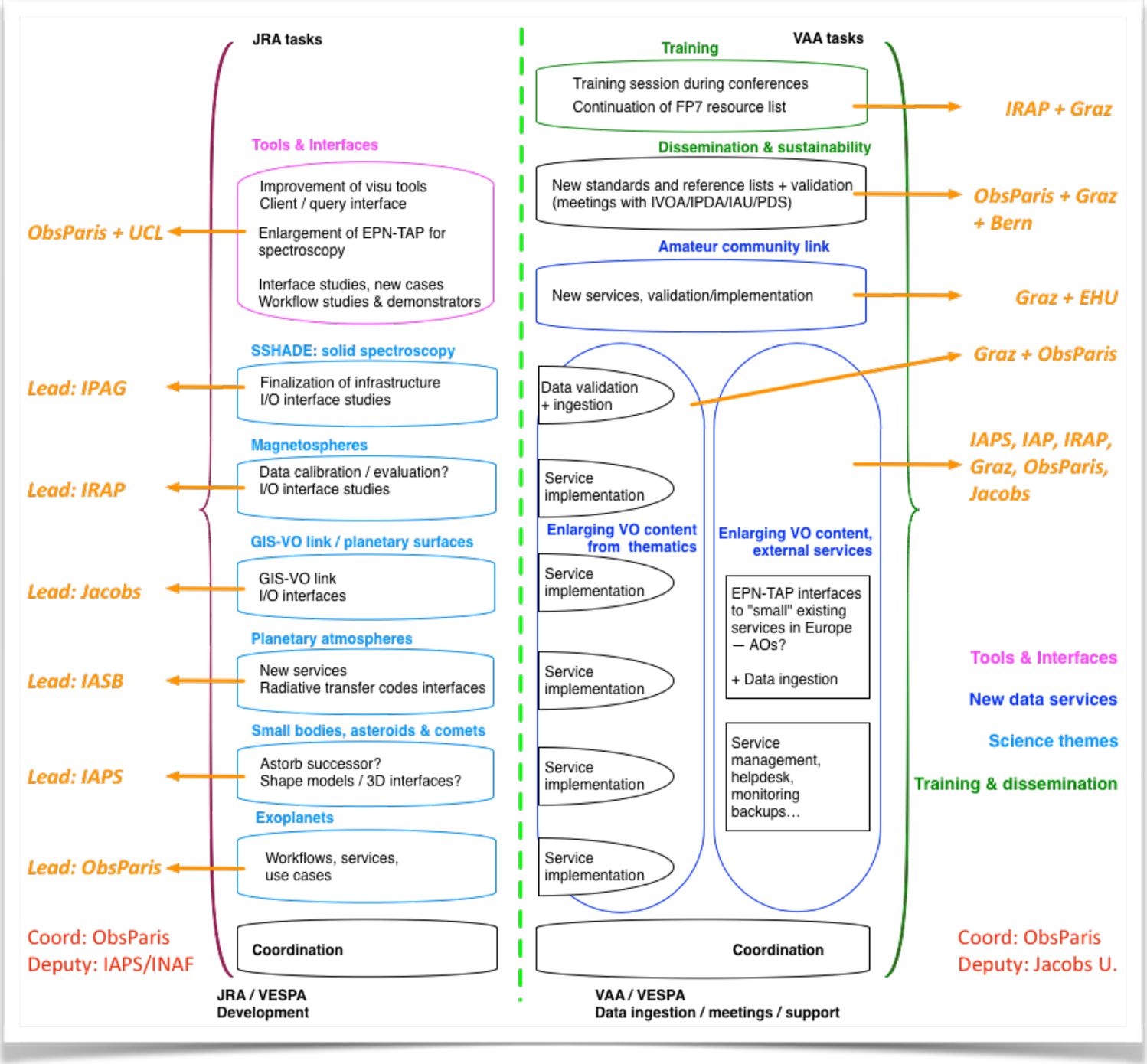
- EPN-TAP Client = VESPA (Virtual European Solar and Planetary Access) http://vespa.obspm.fr

EPN-TAP Search Parameters

- EPN-TAP = TAP +EPNcore keywords (planetary sciences specific)
- **EPNCore** mandatory keywords:
  - *dataproduct_type*: Image, spectrum, time series, dynamic spectrum...
  - Observation target: *target_name, target_class*
  - Temporal parameters: *time_min, time_min, 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)*

Europlanet-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 Wroclaw

Univ. Bern

GFI Toulouse

VESPA Tutorials

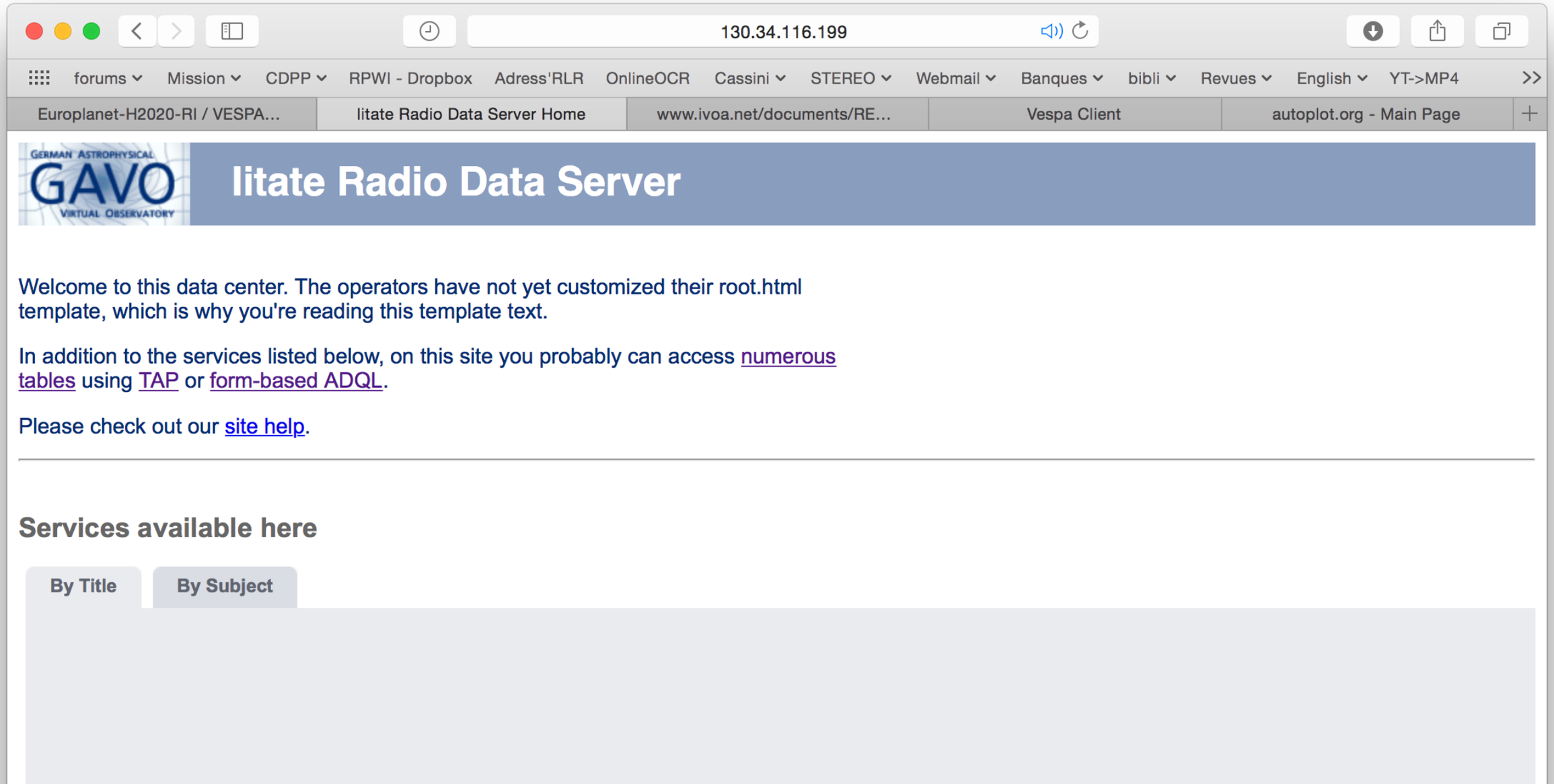
- **Data User Tutorials**:
  http://typhon.obspm.fr/VESPA-tutorials/index.php?page=1
  Tutorial splinter sessions at EGU and EPSC every year.
  This year EGU: Tuesday April 19th Room 2.97 13:30-19:00

- **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 Iitate Radio Observatory (Japan)

- Direct access to server:
  http://130.34.116.199



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
  Schema Name : iitate

130.34.116.199

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Europlanet-H2020-RI / VESPA - VESPA -... | ADQL Query | www.ivoa.net/documents/REC/ADQL/... | Vespa Client

GERMAN ASTROPHYSICAL VIRTUAL OBSERVATORY GAVO

ADQL Query

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]: 5

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: HTML

Go

[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.

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

130.34.116.199

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Europlanet-H2020-RI / VESPA - VESPA -... | ADQL Query | www.ivoa.net/documents/REC/ADQL/... | Vespa Client

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

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

vespa.obspm.fr

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Europlanet-H2020-RI / VESPA - VESPA -... | ADQL Query | www.ivoa.net/documents/REC/ADQL/... | Vespa Client

All VO | Custom resource | Direct Query | Help

Query form: custom resource

Resource URL: http://130.34.116.199/__syste

Schema name: iitate

Target name:

Target class: asteroid, comet, dwarf_planet, exoplanet, interplanetary_medium, planet

Resource type: granule

Dataset ID:

Time selection: Data range is included in | the range between

Time min: 2015-02-01T00:00:00.00

Time max: 2015-03-01T00:00:00.00

Dataproduct type: image, spectrum, dynamic_spectrum, spectral_cube

Measurement type:

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

Query this resource | Reset

Plotting tools

- TOPCAT
- Aladin
- VOSpec
- SPLAT

Example queries

- Saturn in March 2012

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Contact : support.epntap@obspm.fr
Layout based on YAML

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Europlanet-H2020-RI / VESPA - VESPA -... | ADQL Query | www.ivoa.net/documents/REC/ADQL/... | Vespa Client

VESPA

Virtual European Solar and Planetary Access

Query results for specific schema : iitate

granule

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'
```

Plotting tools

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- Aladin
- VOSpec
- SPLAT

Example queries

- Saturn in March 2012

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Contact : support.epntap@obspm.fr
Layout based on YAML

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Europlanet-H2020-RI / VESPA - VESPA -... | ADQL Query | www.ivoa.net/documents/REC/ADQL/... | Vespa Client

VESPA

Virtual European Solar and Planetary Access

All VO | Custom resource | Direct Query | Help

Results in service iitate

Full Text

Show 20 entries | Search: | 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 | First | Previous | 1 | 2 | Next | Last

Download selection | SAMP selection as | Samp VOTable selection | Samp all VOTable

Plotting tools

- TOPCAT
- Aladin
- VOSpec
- SPLAT

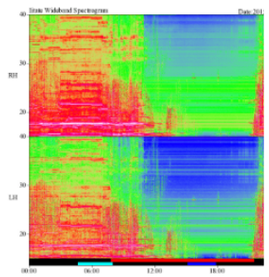
Example queries

- Saturn in March 2012

SELECTED DATA

1 selected data
- 1 : dynamic_spectrum

PREVIEW



Afficher un menu

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Examples

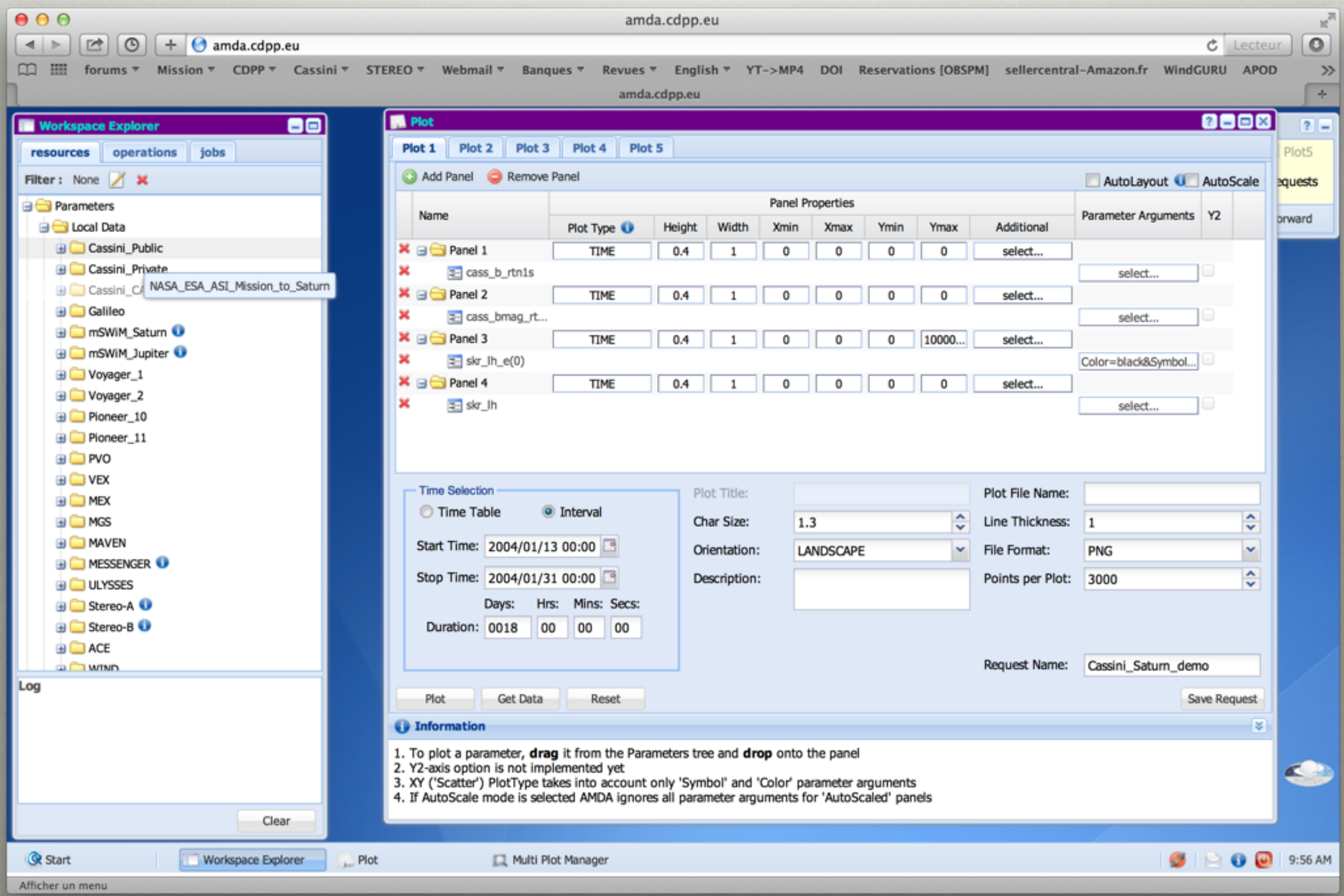
- Examples extracted from online videos produced for EPSC-2013 (London). http://voparis-europlanet.obspm.fr/docum.shtml

- **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

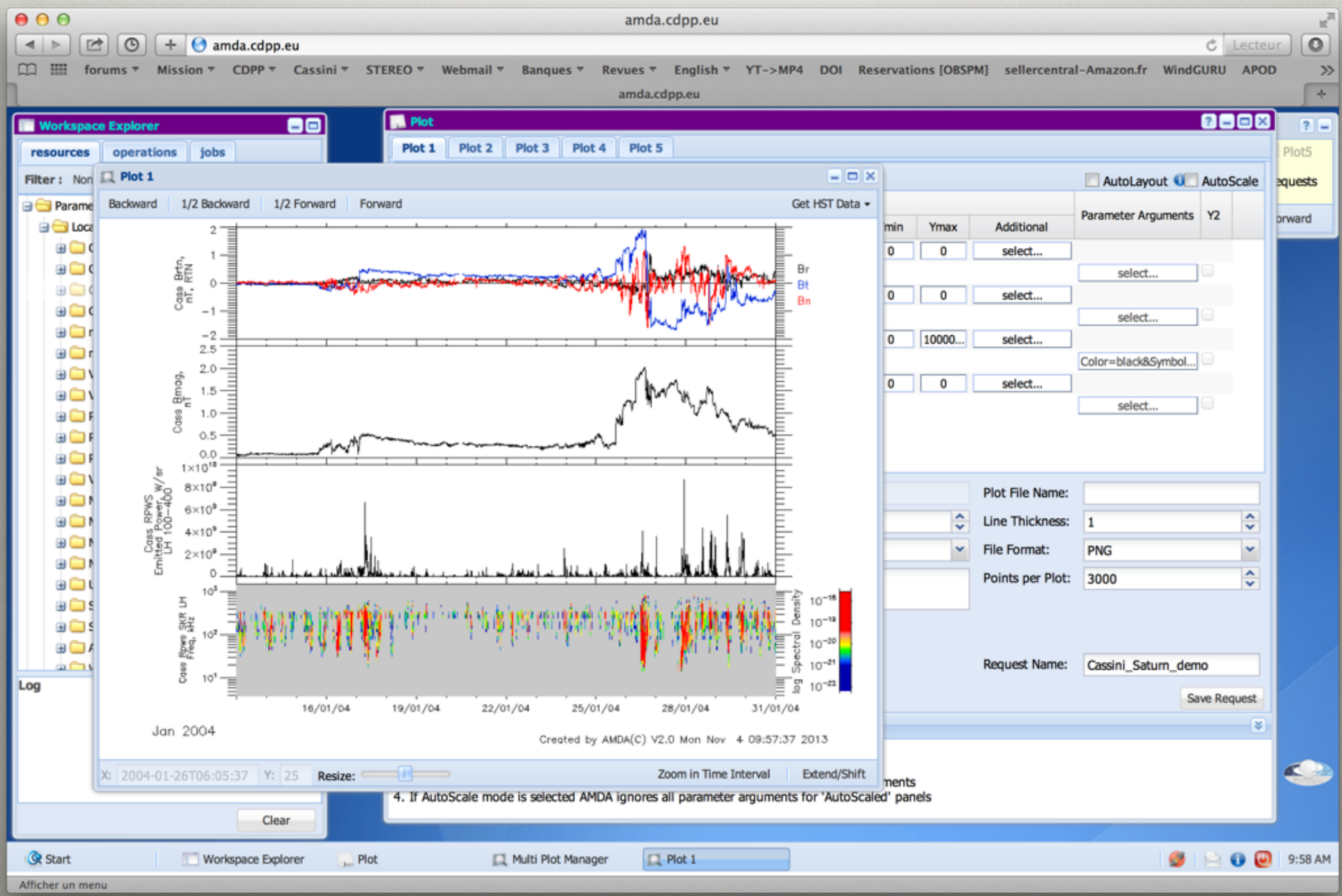
Example 1:
Auroral Physics at Saturn



http://amda.cdpp.eu

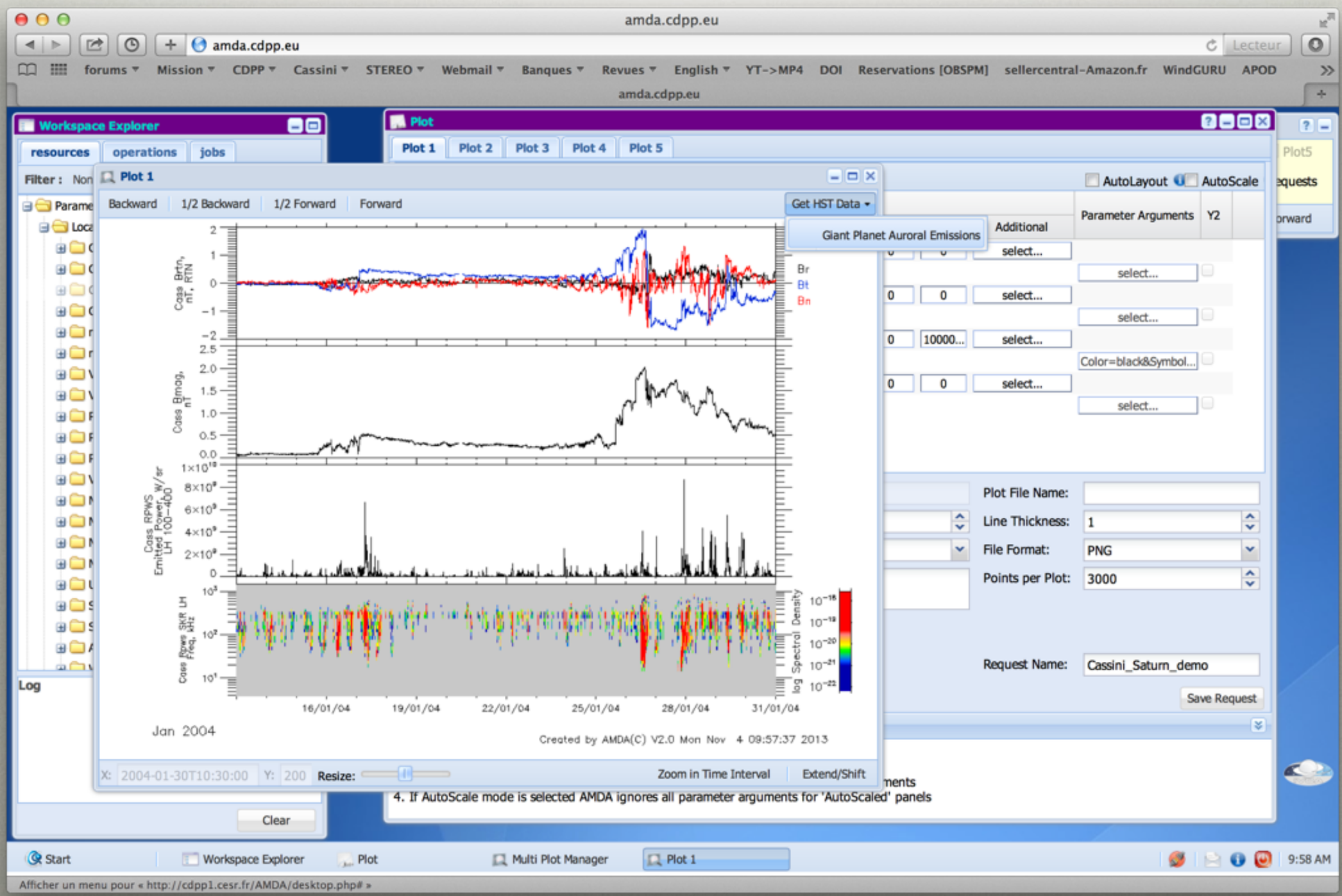
Cassini data in AMDA, building plot result

Example 1:
Auroral Physics at Saturn



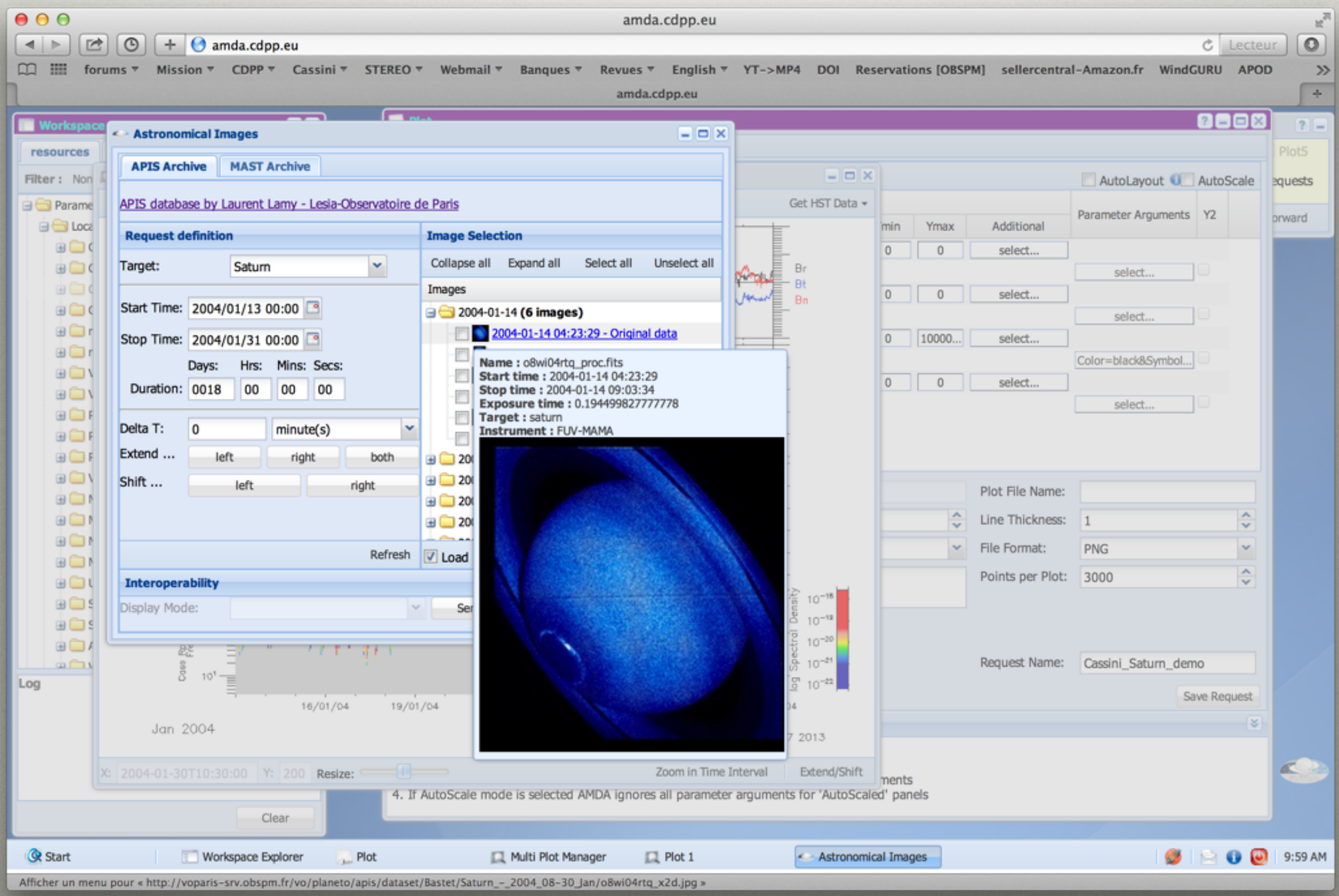
Plot result

Example 1:
Auroral Physics at Saturn



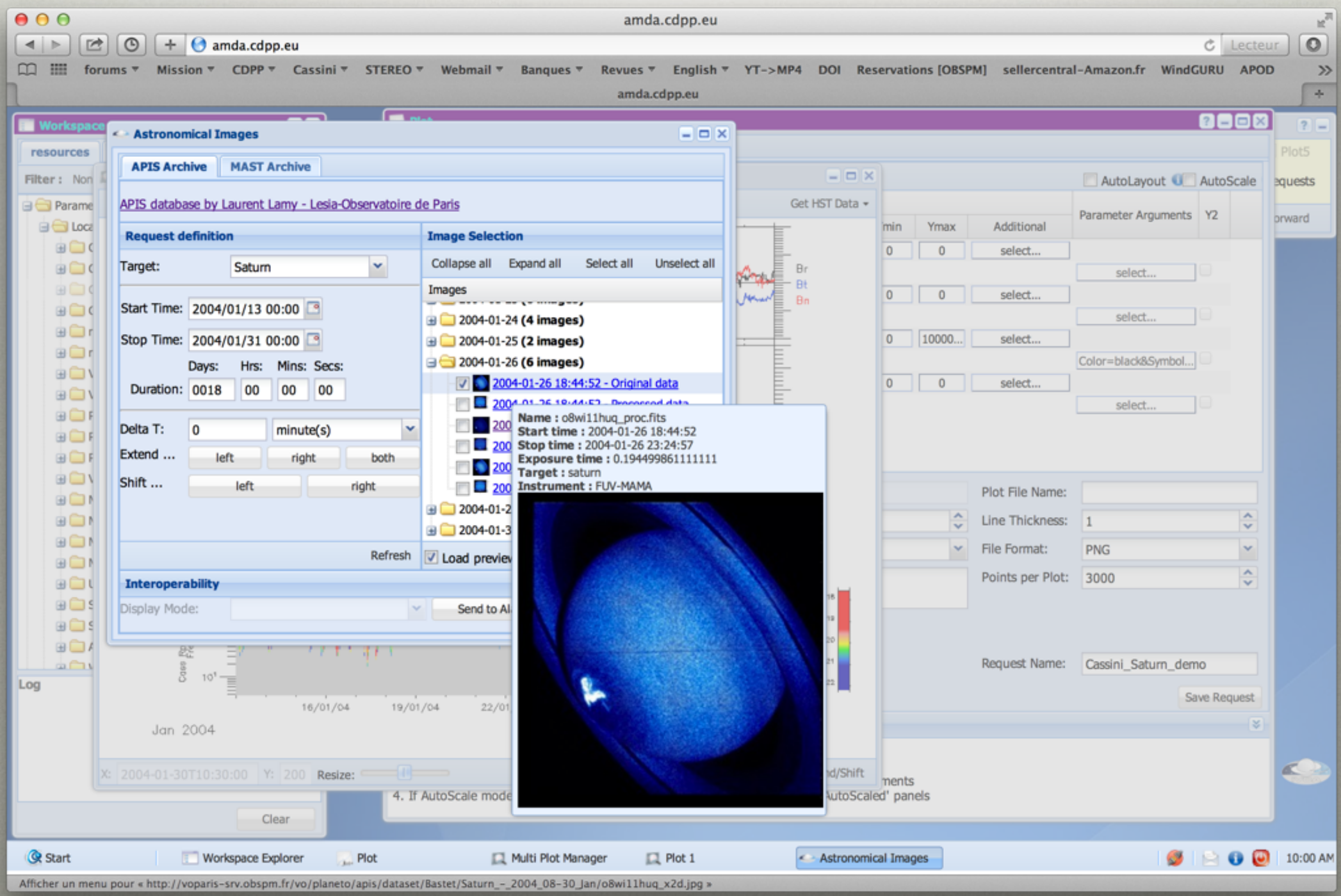
HST data access menu

Example 1:
Auroral Physics at Saturn



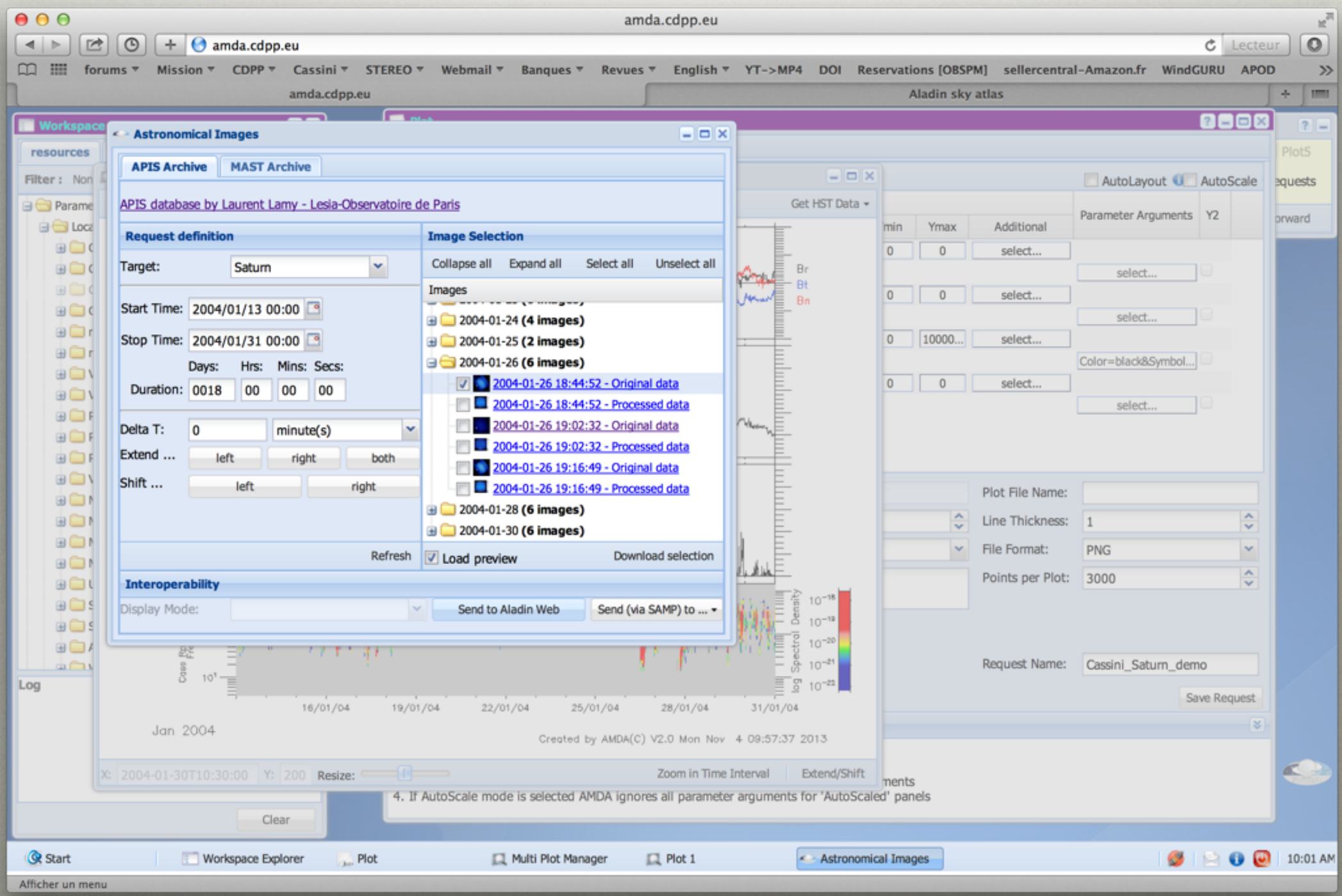
Access to APIS data through EPN-TAP

Example 1:
Auroral Physics at Saturn



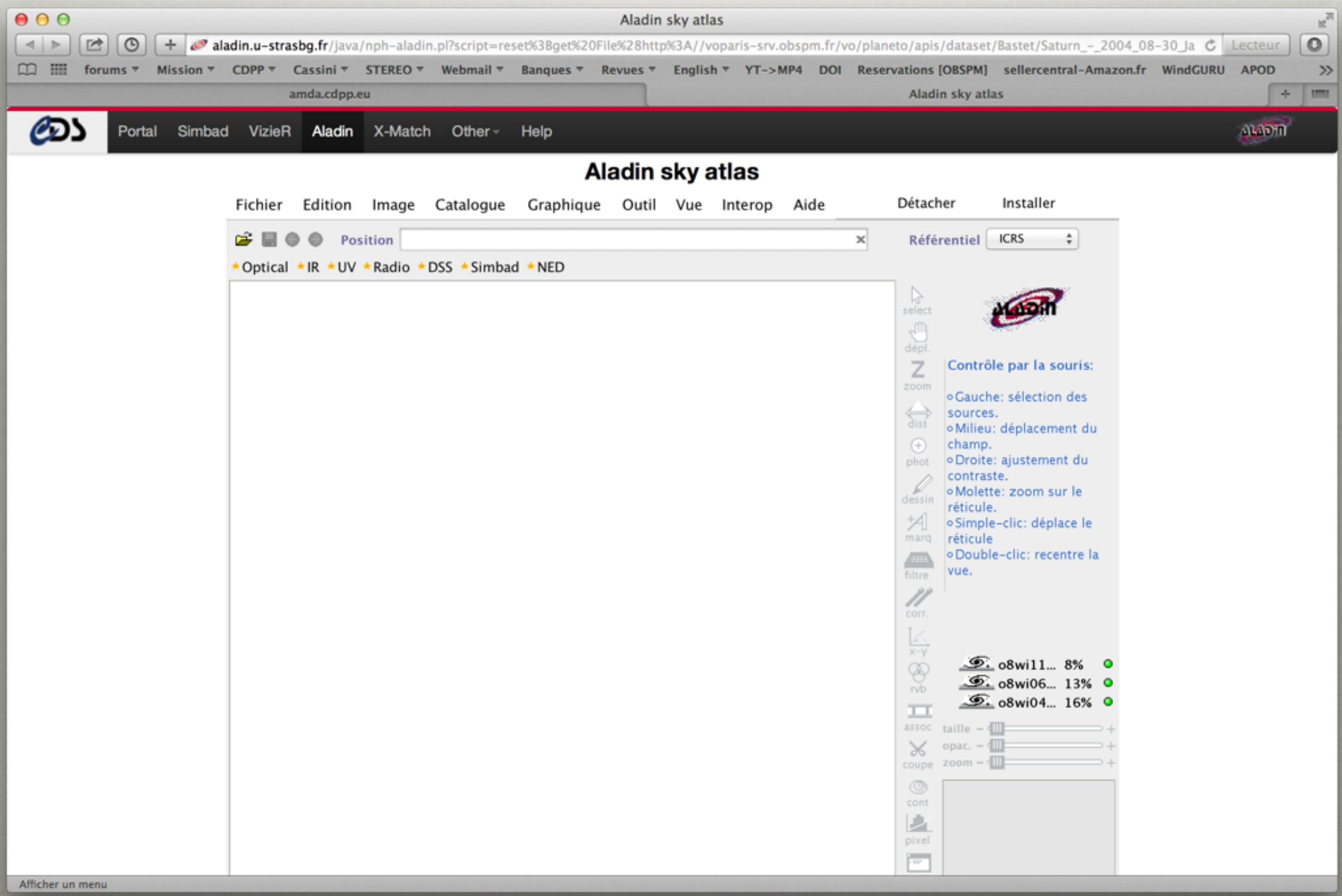
Access to APIS metadata through EPN-TAP

Example 1:
Auroral Physics at Saturn



Send selected data to Aladin (IVOA image viewer)

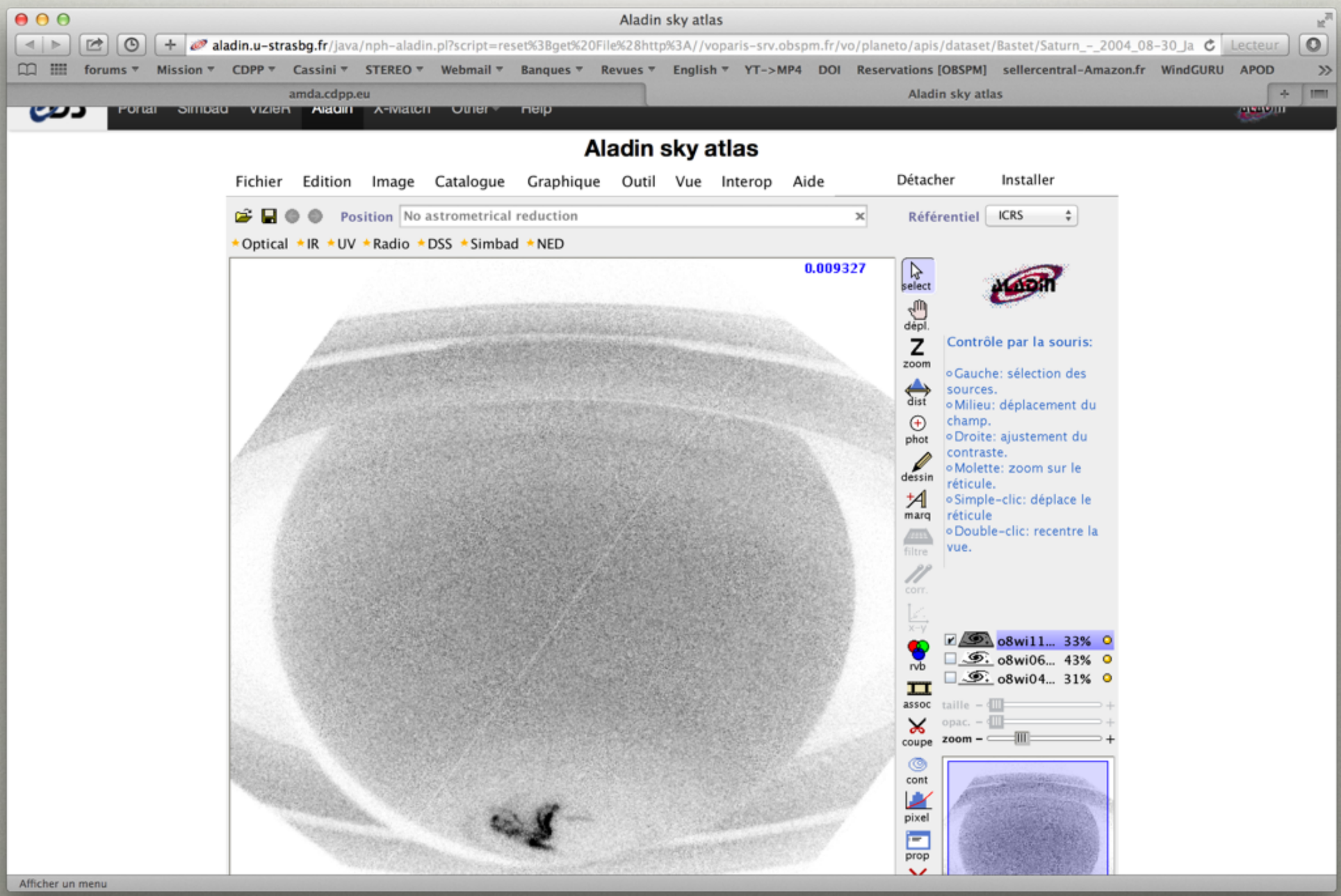
Example 1:
Auroral Physics at Saturn



http://aladin.u-strasbg.fr

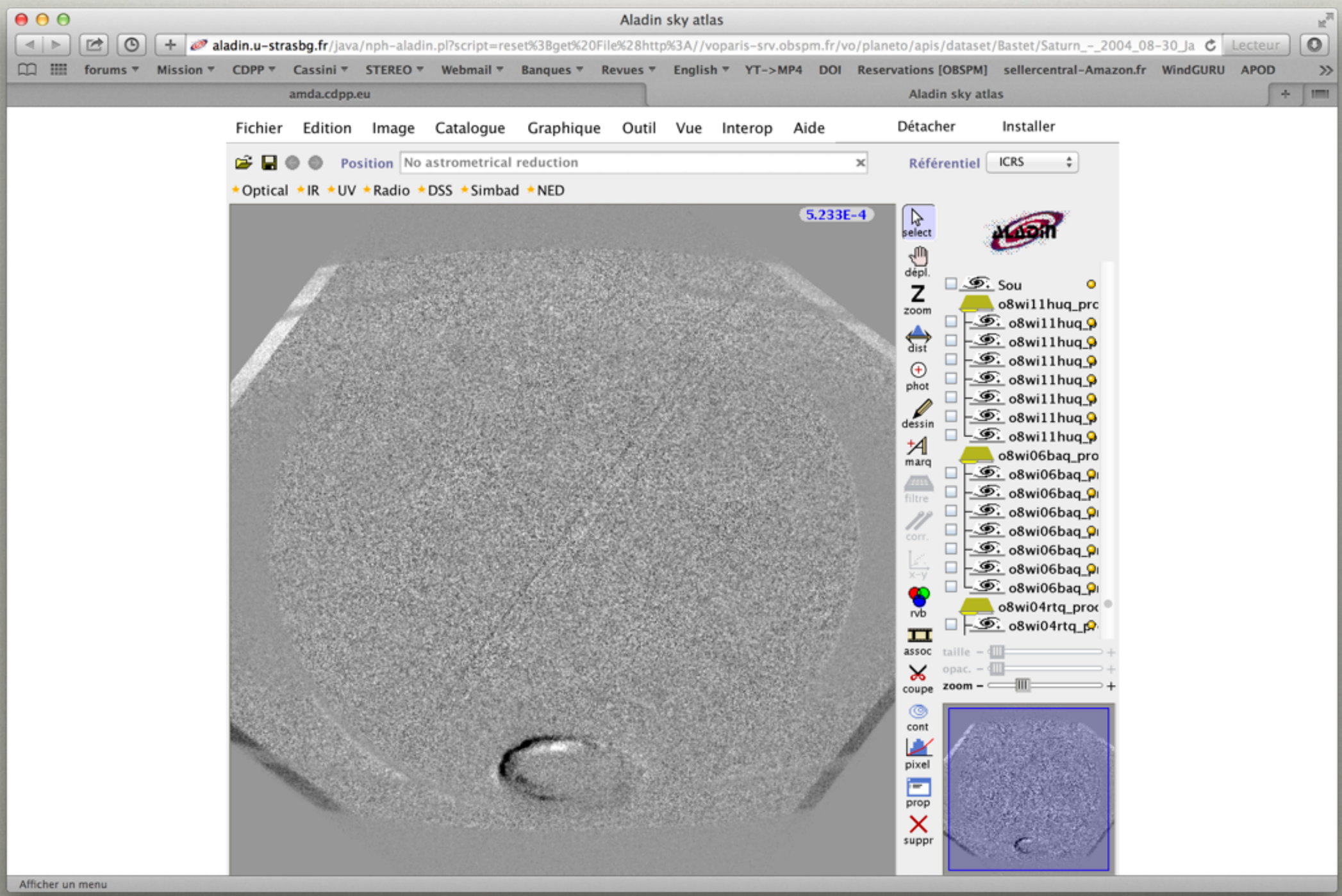
Aladin Web launched in another window

Example 1:
Auroral Physics at Saturn



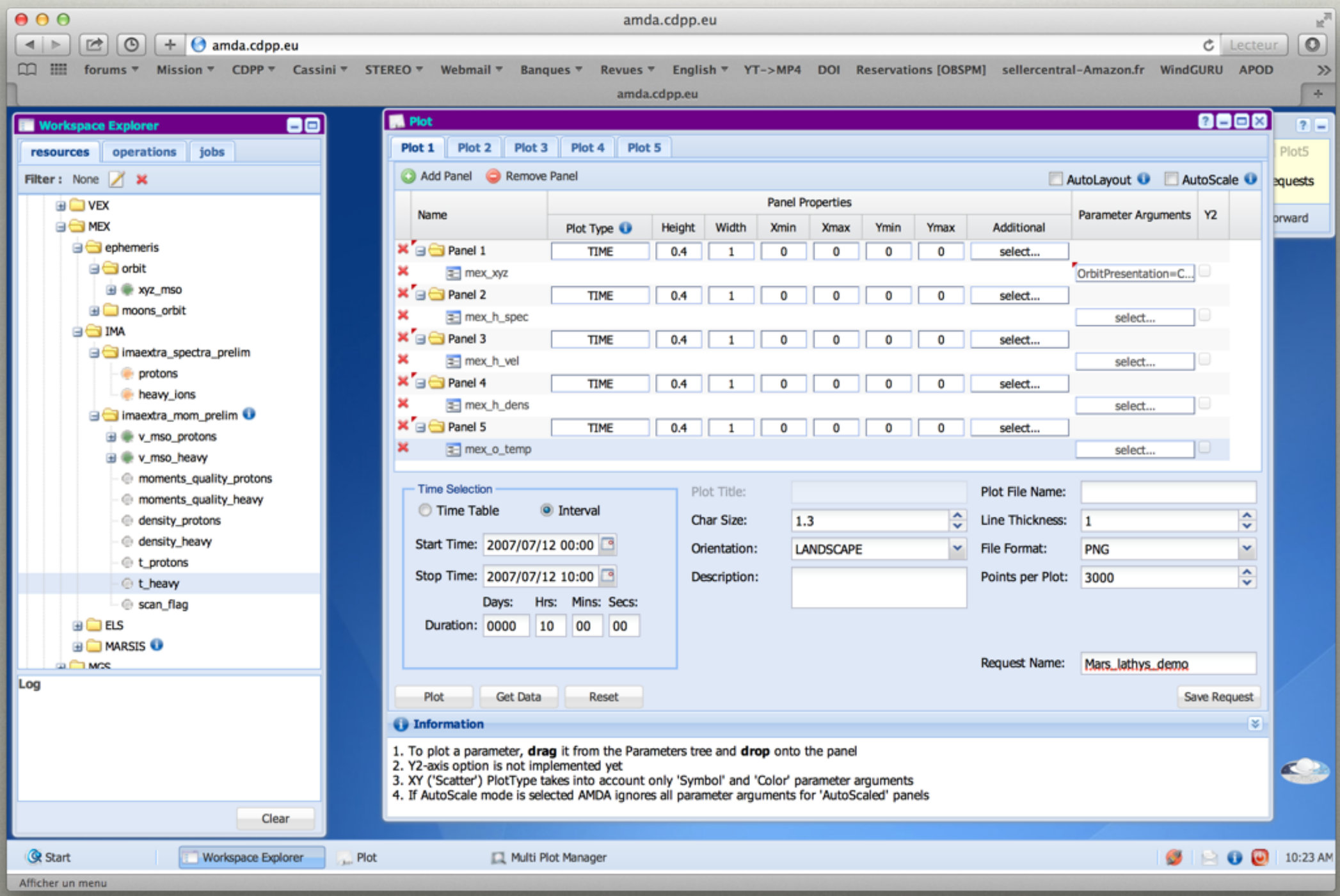
Data are loaded into Aladin from their URL in APIS

Example 1:
Auroral Physics at Saturn



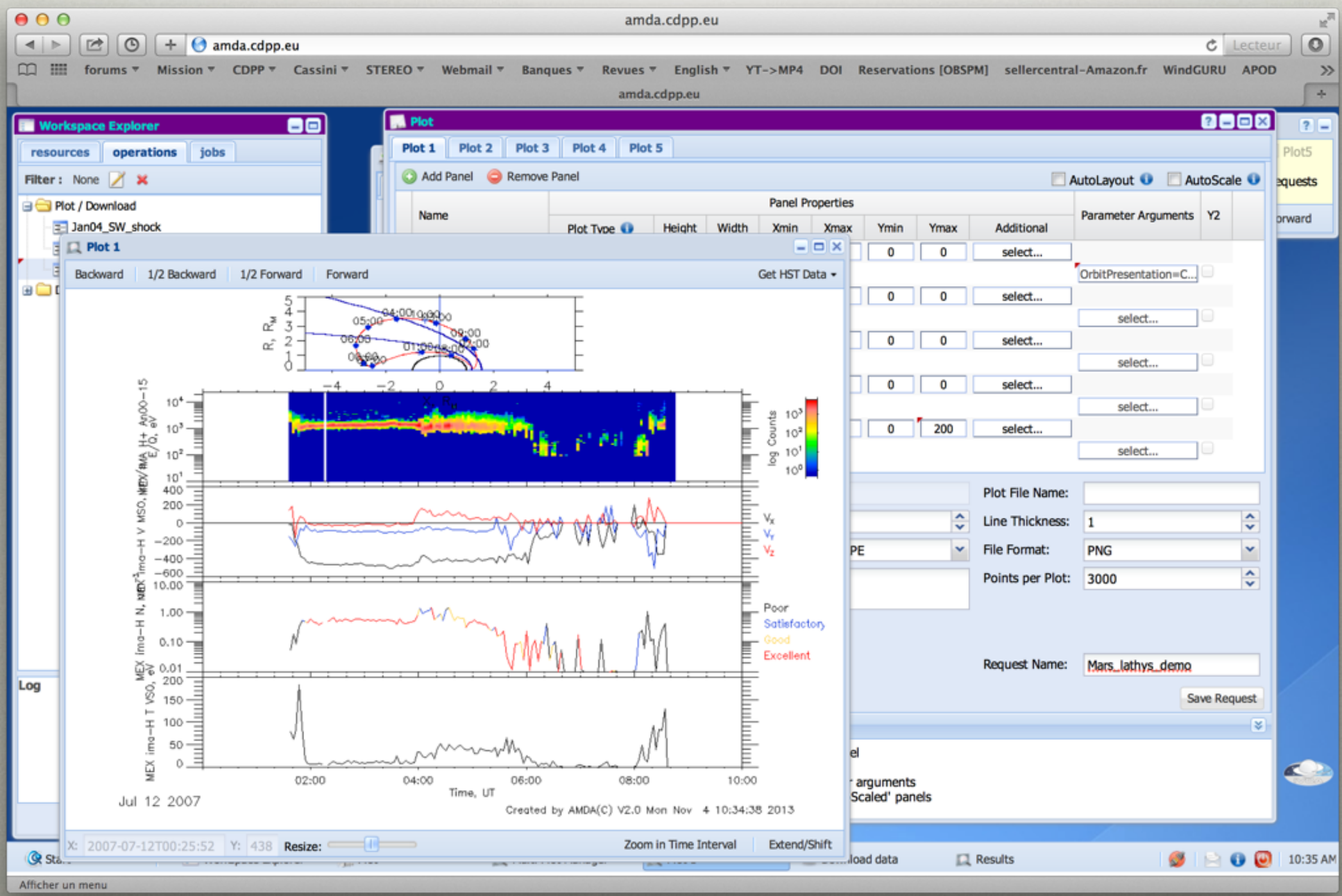
Basic operations: here image subtraction

Example 2:
Solar Wind at Mars



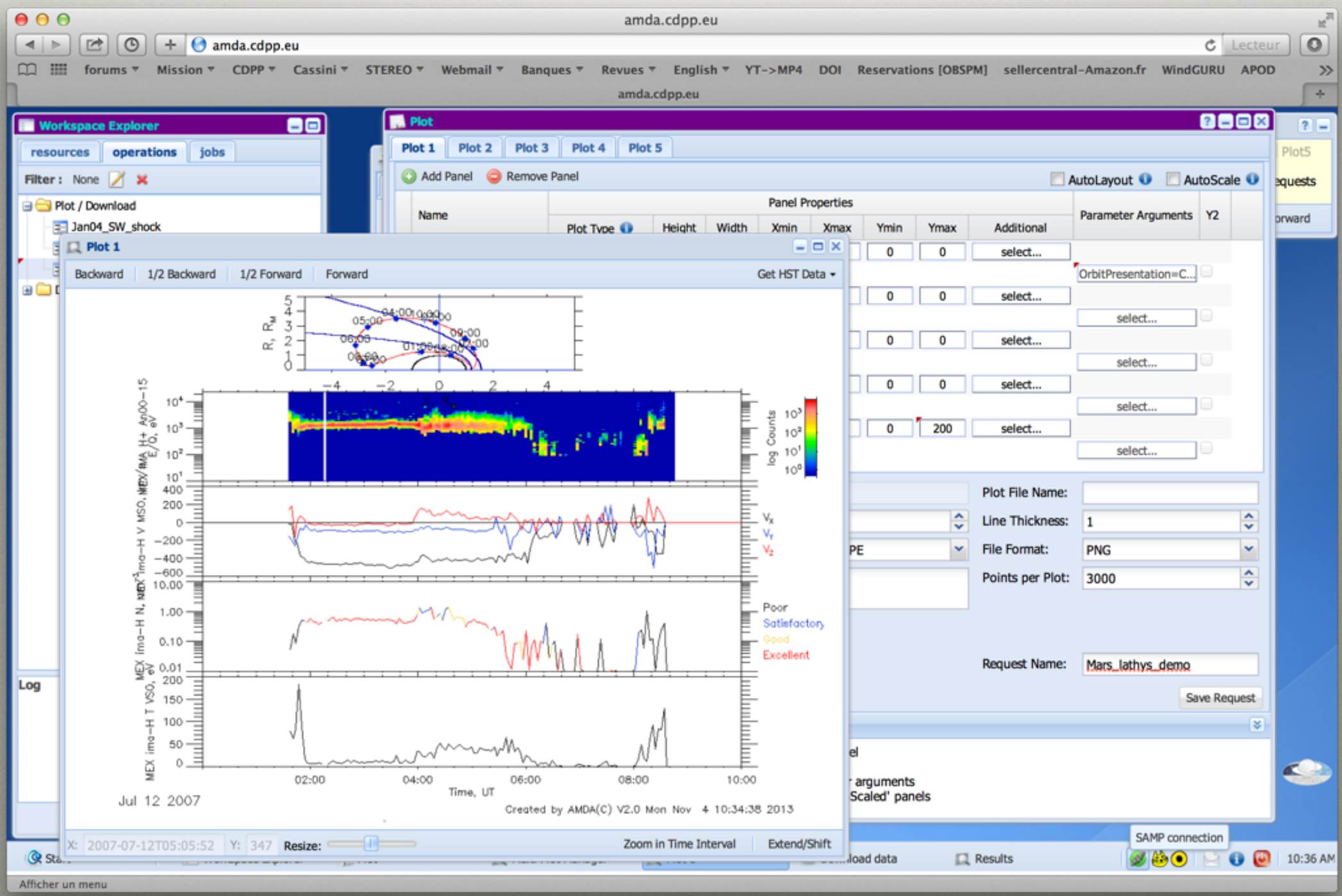
Mars Express data in AMDA on day 2007/07/12

Example 2:
Solar Wind at Mars



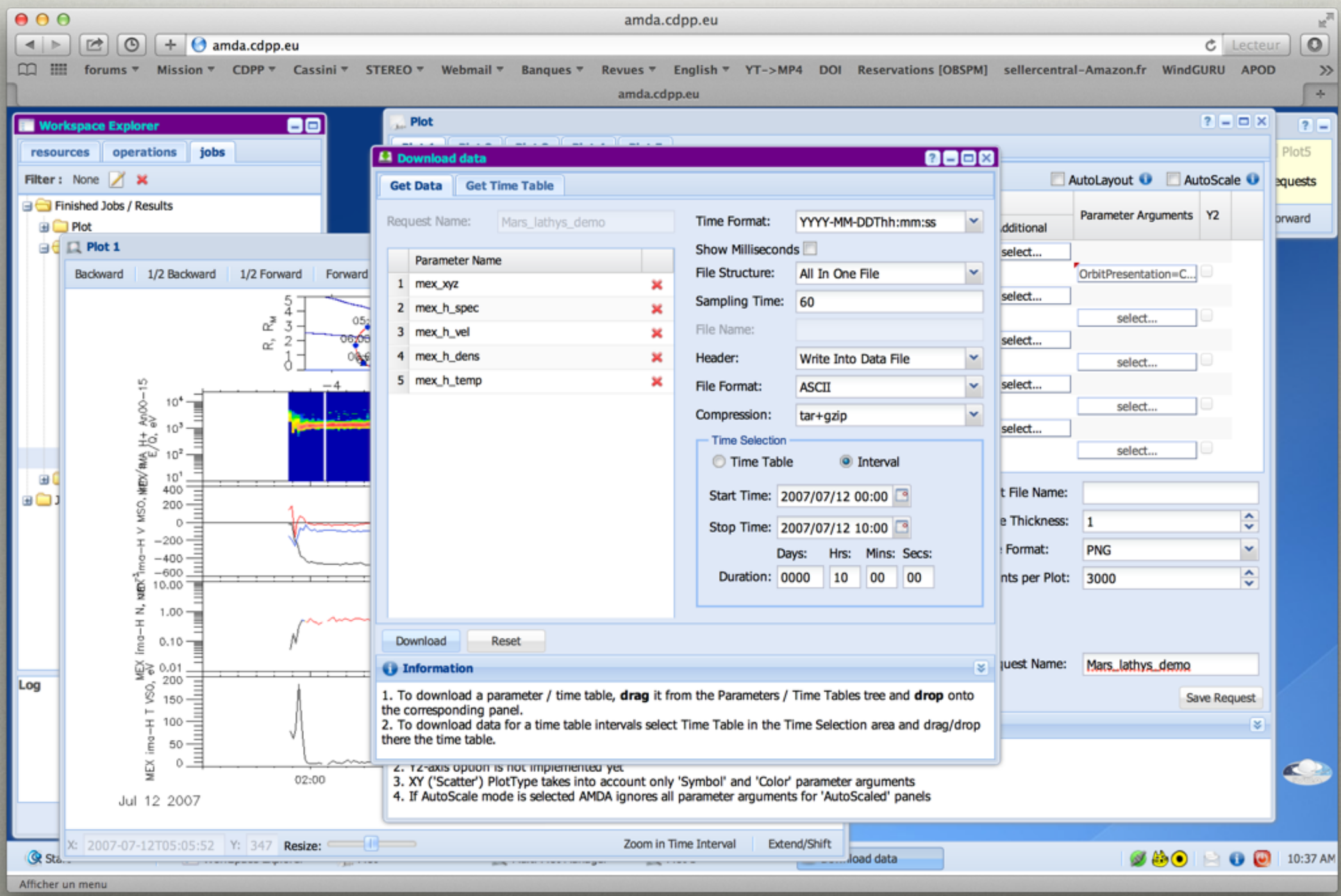
Plot results

Example 2:
Solar Wind at Mars



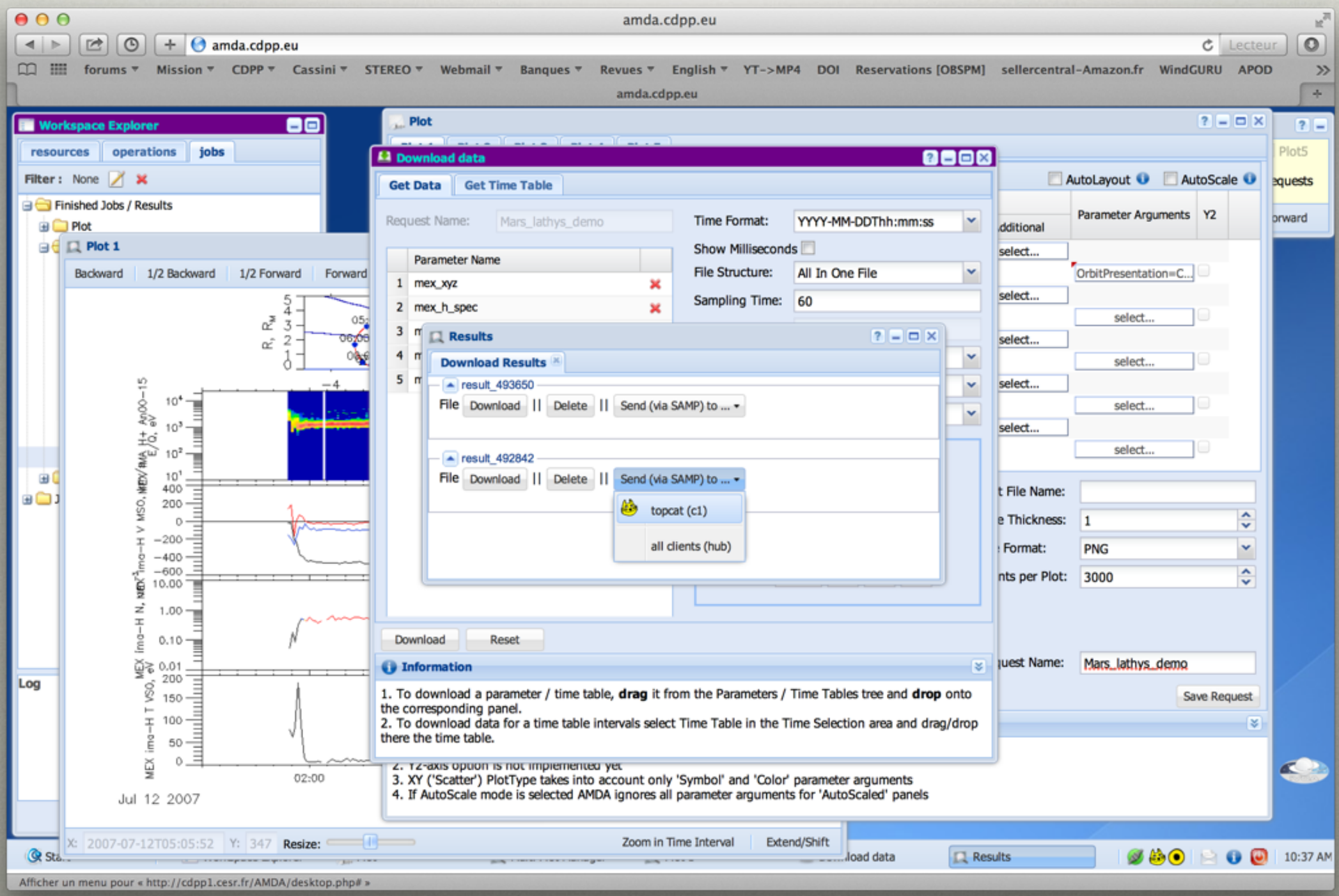
Connecting AMDA to TOPCAT (IVOA Table Data tool) with SAMP

Example 2:
Solar Wind at Mars



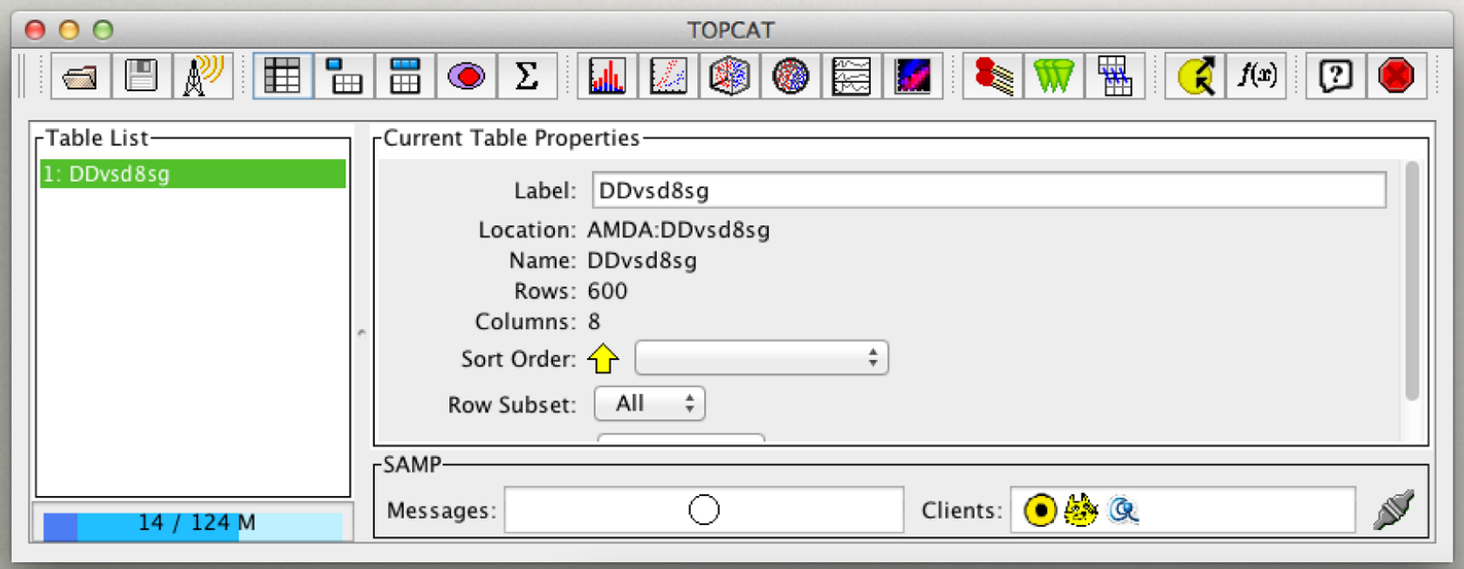
Preparing data transfer to TOPCAT

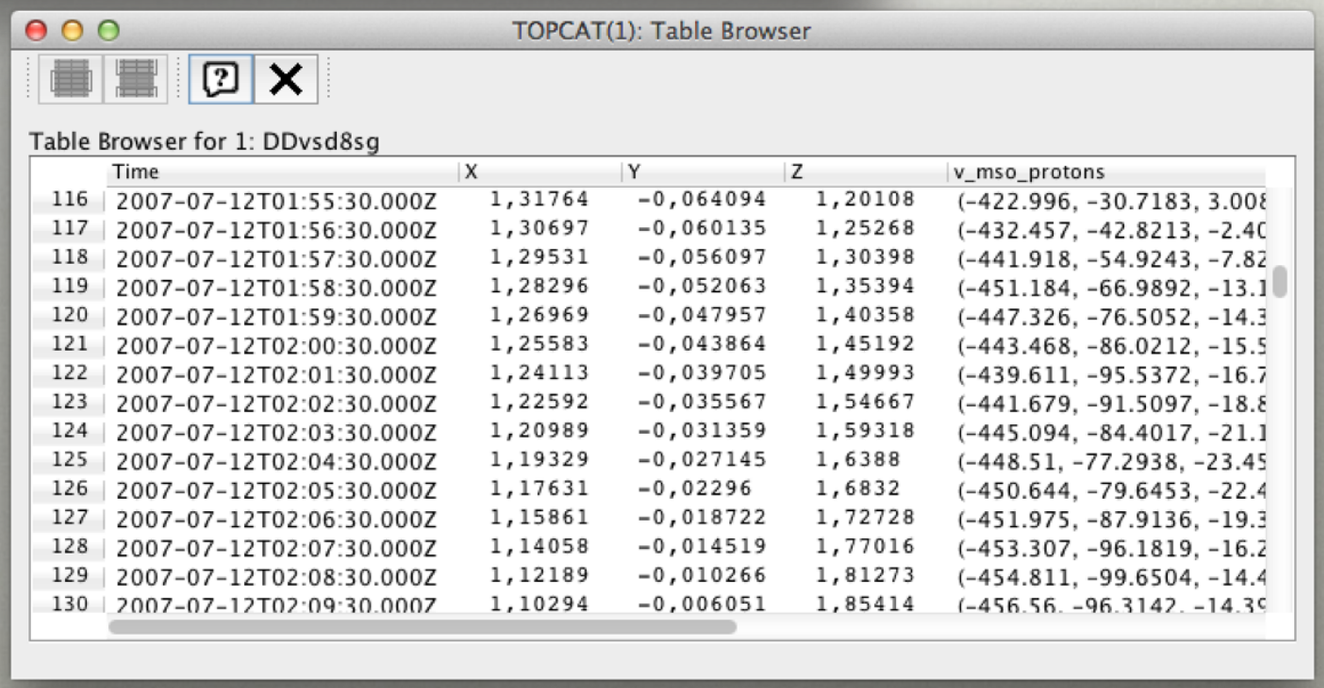
Example 2:
Solar Wind at Mars



Sending data to TOPCAT

Example 2:
Solar Wind at Mars



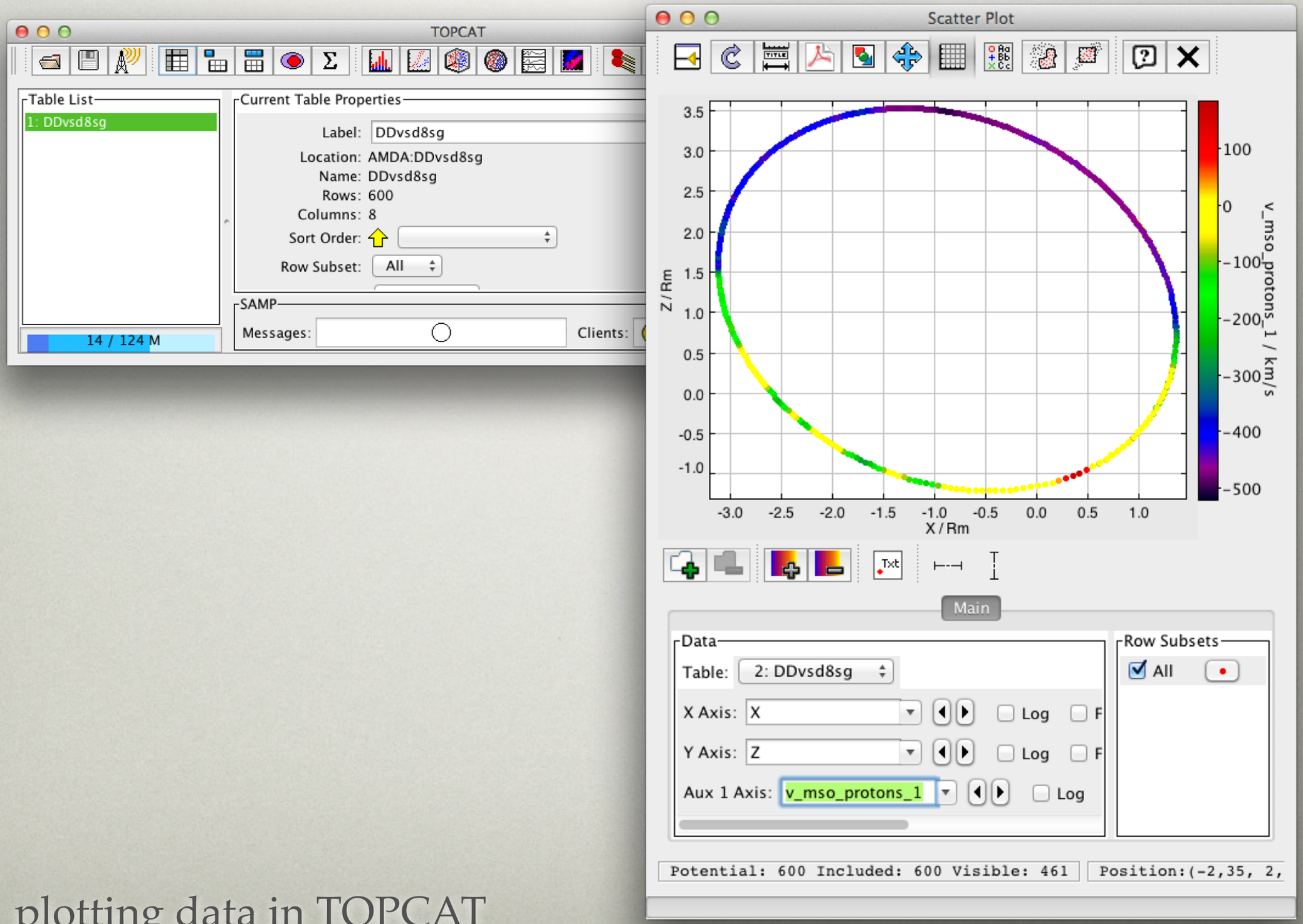


	Time	X	Y	Z	v_mso_protons
116	2007-07-12T01:55:30.000Z	1,31764	-0,064094	1,20108	(-422.996, -30.7183, 3.008
117	2007-07-12T01:56:30.000Z	1,30697	-0,060135	1,25268	(-432.457, -42.8213, -2.40
118	2007-07-12T01:57:30.000Z	1,29531	-0,056097	1,30398	(-441.918, -54.9243, -7.82
119	2007-07-12T01:58:30.000Z	1,28296	-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, -14.39

http://www.star.bris.ac.uk/~mbt/topcat/

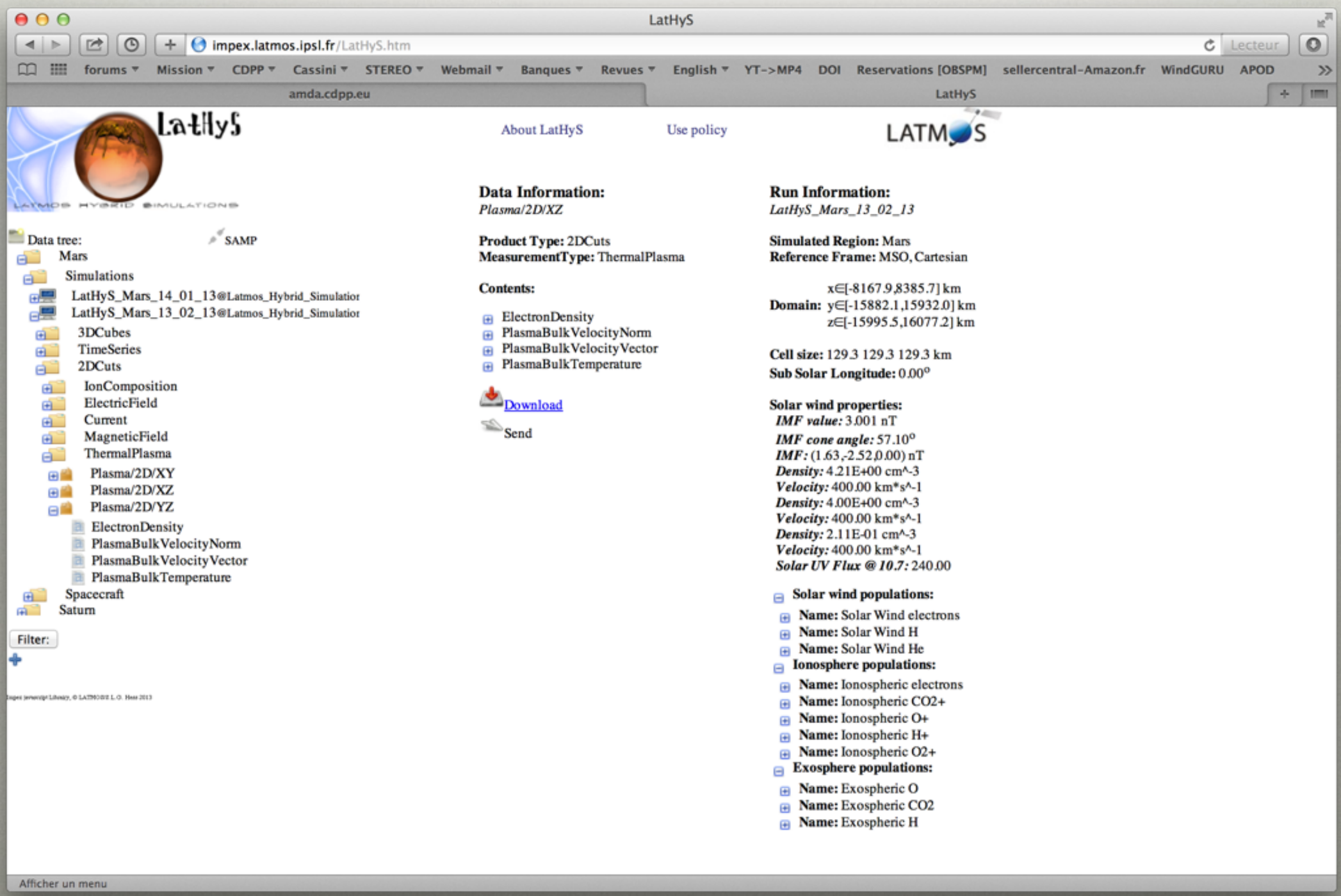
Displaying table in TOPCAT

Example 2:
Solar Wind at Mars



plotting data in TOPCAT

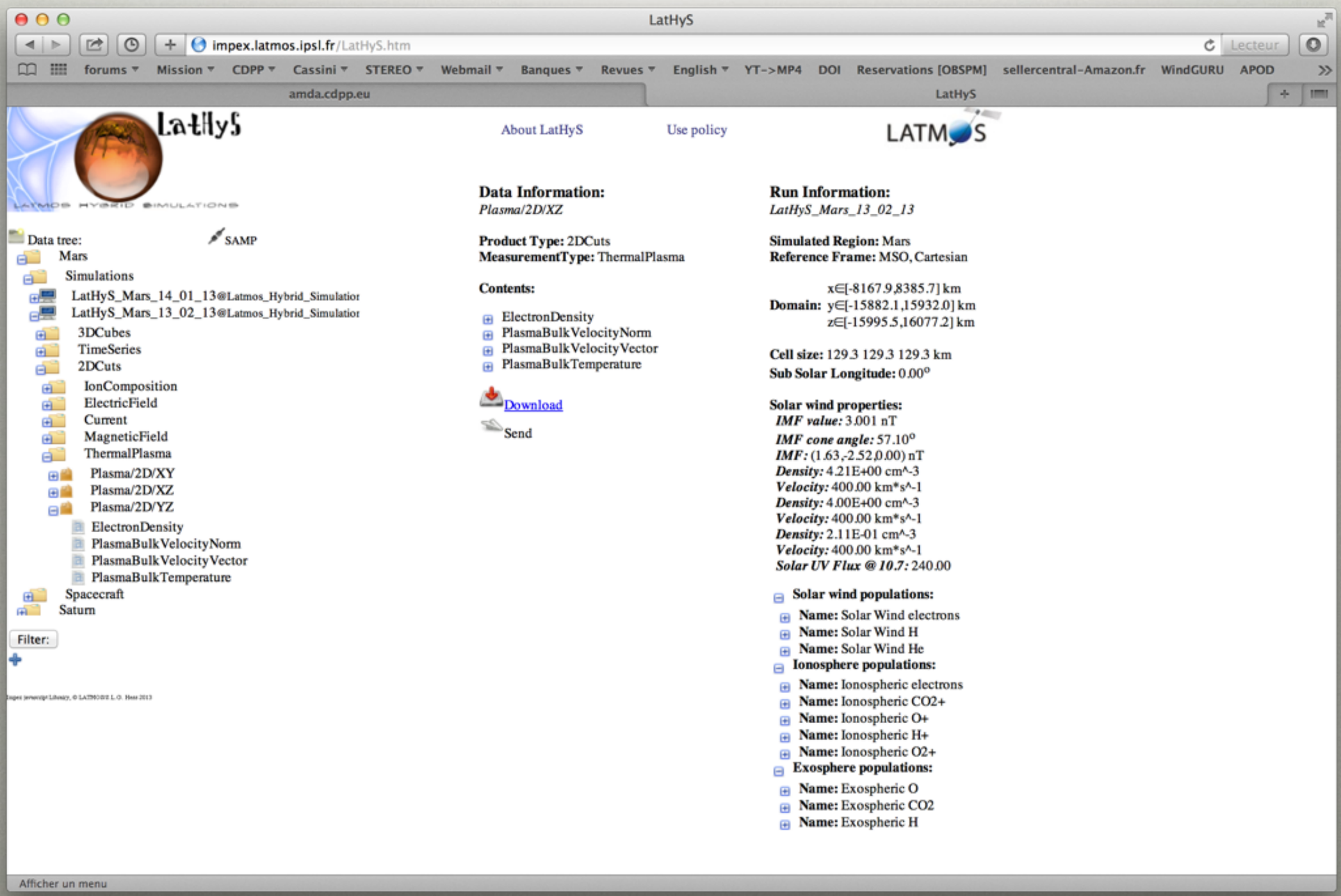
Example 2:
Solar Wind at Mars



http://impex.latmos.ipsl.fr/LatHyS.htm

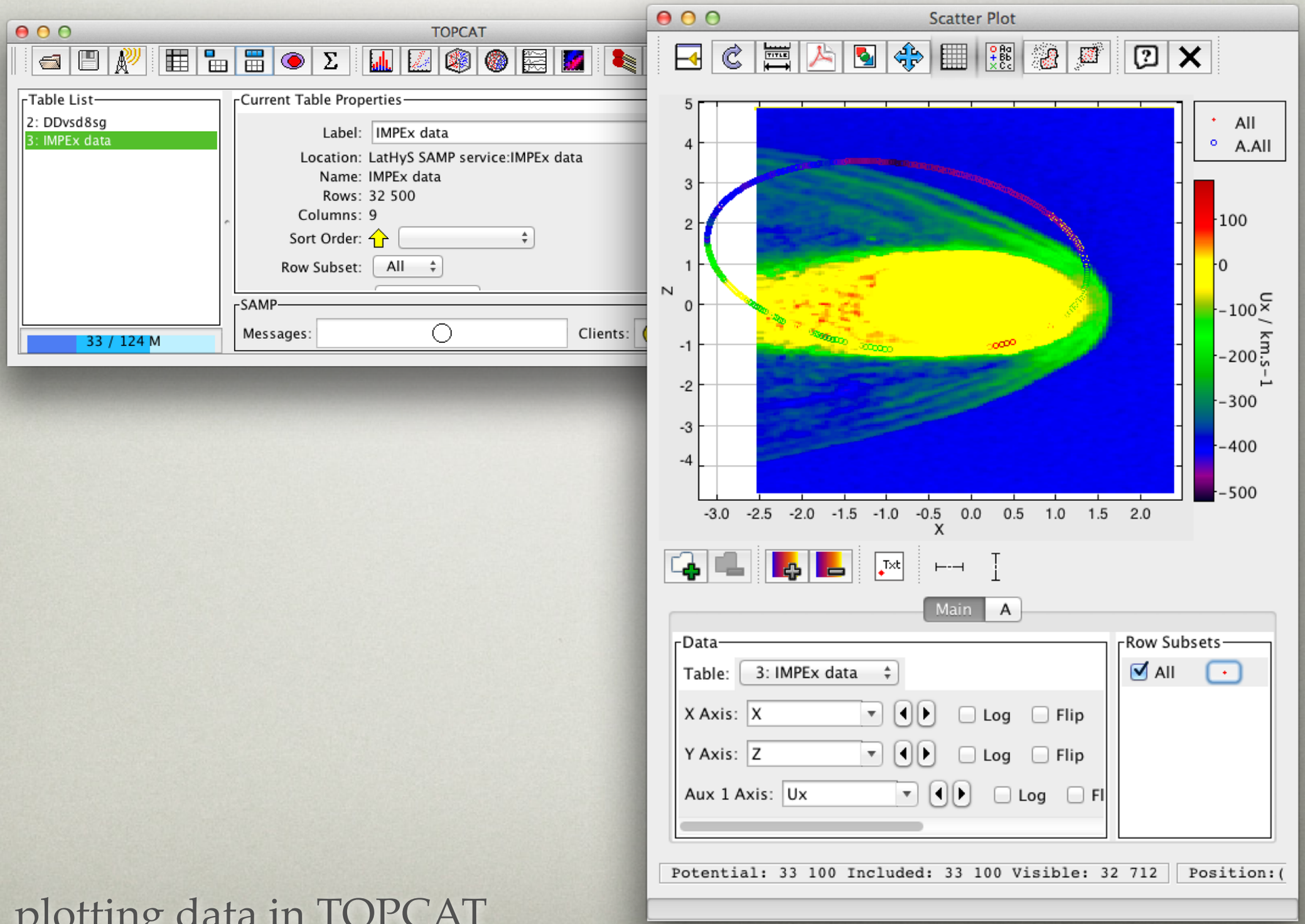
Data tree in LatHyS (SPASE-based)

Example 2:
Solar Wind at Mars



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

Example 2:
Solar Wind at Mars



plotting data in TOPCAT