A Planetary Science Virtual Observatory prototype
(and follow-on)

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+ Many contributions from
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etc

Forum OV-Paris, June 2014
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- Résults from Europlanet-RI program (ended Dec 2012)

  => VO infrastructure defined and installed

  => Some services on-line (demos) + many projects

  VO-Paris was a major contributor

- European follow-on in Horizon 2020:

  - Work Package focused on VO services in Europlanet H2020: VESPA

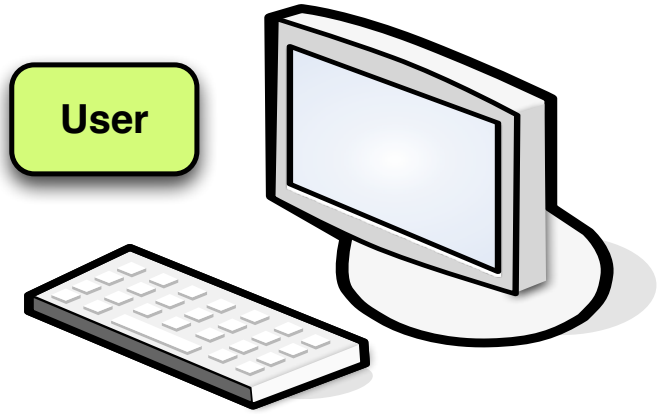
  - Objectives? — Essentially availability of new data content

  - 16 partners, including: OV-Paris, IRAP, IPAG, LATMOS, GEOPS, CDS, IAPS/INAF, Jacobs Univ, IWF Graz, IASB, UCL, IAP Prague, EHU Bilbao

- Space mission context:

  - Some themes particularly supported, involve heavy developments

User's experience



User

Queries

Answers

Catalogue / Registry

Data access

SSODnet

GhoSST KIDA

PSA

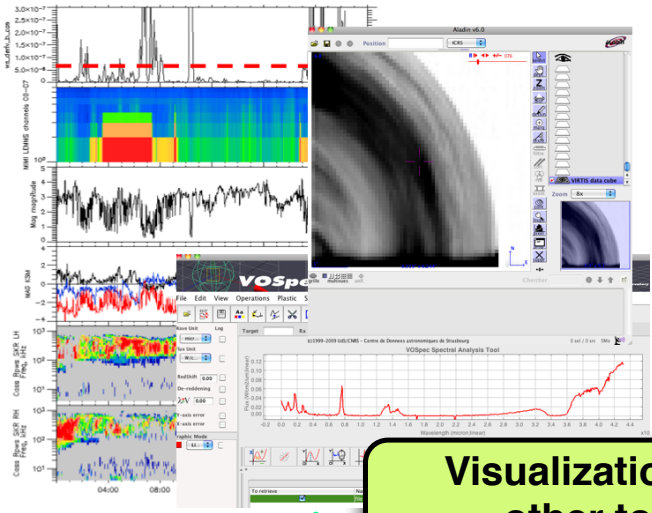
AMDA…

EPN

PDS

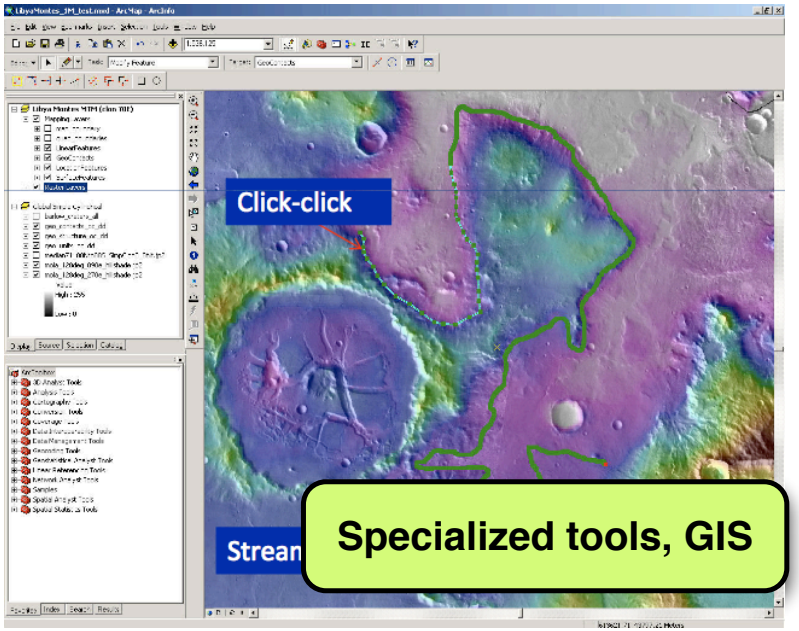
Data bases

Space agency archives



Data exchange

Visualization and other tools



Specialized tools, GIS

Planetary Science VO — Objectives in Europlanet
(FP7: 2009-2012)

- Make data search in archives easy
- Allow quick-look visualisation of data
- Allow external users to include their data

} Initial set-up in Europlanet

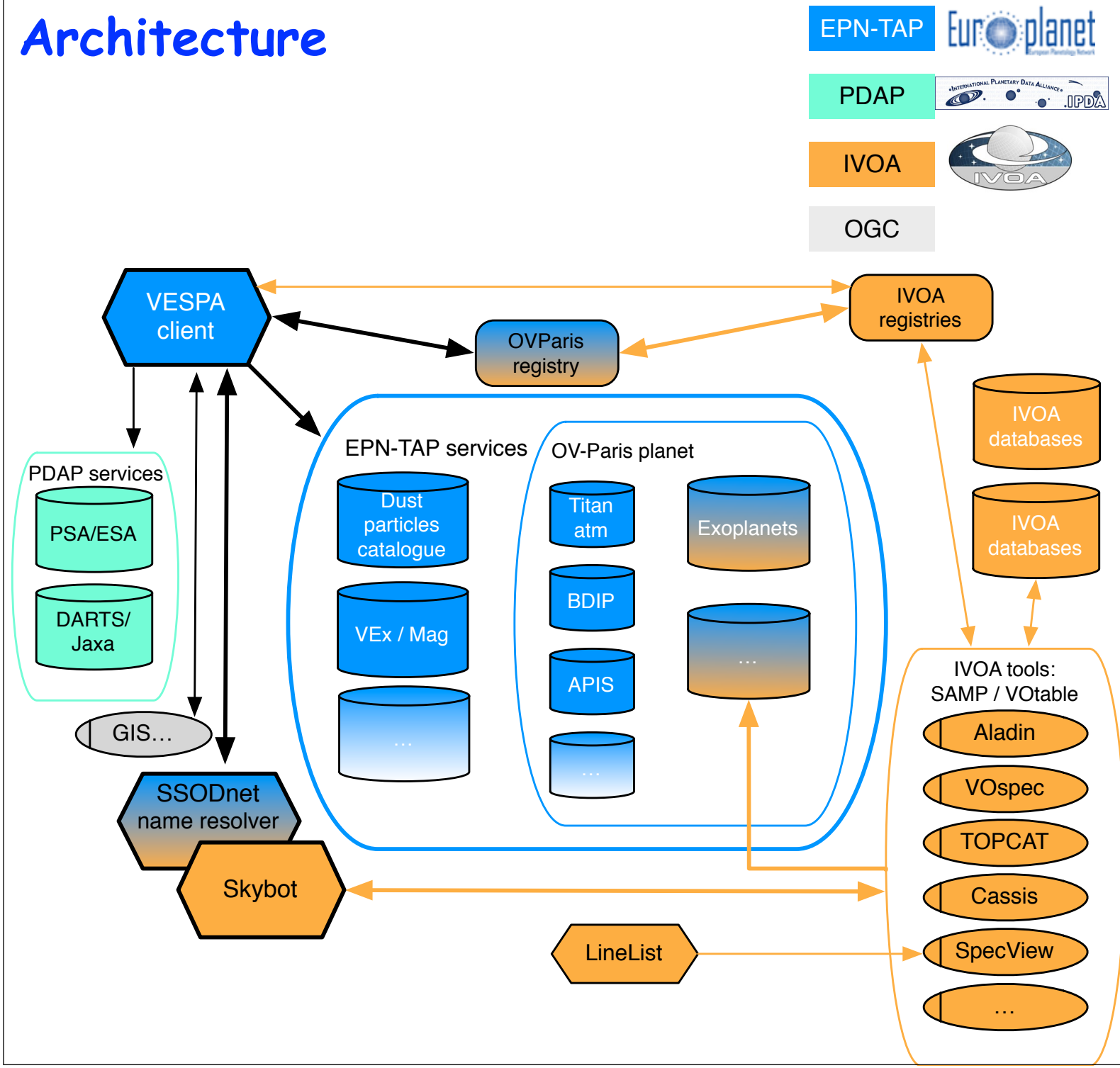
- Make "small" derived data sets accessible
- Develop specific processing/visualisation tools

} Contributions by external users

Constraint: minimise developments

Success: the user doesn't see the infrastructure

Architecture



VESPA access

- Global search interface for Planetary Science services
- Supports EPN-TAP + PDAP

http://vespa.obspm.fr

Query form: All VO

Target name

Resource type: granule

Dataset ID

Time selection: Data range is included in

Time min

Dataproduct type: image, spectrum, dynamic_spectrum

Query All VO | Reset

Query results for all resources

gran

EPN Resources

Auroral Planetary Imaging and Spectroscopy
Results : 341
DISPLAY RESULTS
▶ Description :
Credits: Creator

Base de Donn
Results : 0
DISPLAY VOTABLE
▶ Description :
Credits: Creator

Extrasolar Pla
Results : 0
DISPLAY VOTABLE
▶ Description :
Credits: Creator

Heliophysics F
Results : 0
DISPLAY VOTABLE
▶ Description :
Credits: Creator

Results in service apis

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
image	Titan	2009-01-23T16:09:22	2009-01-23T16:19:22	jb9z01011_proc.f
image	Titan	2009-01-23T16:21:40	2009-01-23T16:38:20	jb9z01021_proc.f
image	Titan	2009-01-23T16:41:58	2009-01-23T16:51:58	jb9z01031_proc.f
image	Titan	2009-01-23T17:42:54	2009-01-23T17:52:54	jb9z01041_proc.f
image	Titan	2009-01-23T17:55:12	2009-01-23T18:11:52	jb9z01051_proc.f
image	Titan	2009-01-23T18:15:30	2009-01-23T18:25:30	jb9z01061_proc.f
image	Titan	2009-01-23T19:18:47	2009-01-23T19:28:47	jb9z01071_proc.f
image	Titan	2009-01-23T19:31:05	2009-01-23T19:47:45	jb9z01081_proc.f
image	Titan	2009-01-23T19:51:23	2009-01-23T20:01:23	jb9z01091_proc.f
image	Titan	2009-01-23T16:09:22	2009-01-23T16:12:42	jb9z01a1q_proc.f
image	Titan	2009-01-23T16:21:40	2009-01-23T16:25:00	jb9z01a4q_proc.f
image	Titan	2009-01-23T16:33:40	2009-01-23T16:37:00	jb9z01a7q_proc.f
image	Titan	2009-01-23T16:37:40	2009-01-23T16:41:00	jb9z01a8q_proc.f
image	Titan	2009-01-23T17:46:54	2009-01-23T17:50:14	jb9z01aeq_proc.f
image	Titan	2009-01-23T17:59:12	2009-01-23T18:02:32	jb9z01ahq_proc.f
image	Titan	2009-01-23T18:11:12	2009-01-23T18:14:32	jb9z01alq_proc.f

Plotting tools

- TOPCAT
- Aladin
- VOSpec
- SPLAT

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Example queries

- Saturn in March 2012

SELECTED DATA

1 selected data
- 1 : image

PREVIEW

First data services

- EPN-TAP services:

  Public services at VO-Paris:

  - APIS: Aurorae images/spectra data base (HST)
  - BDIP: Historical planetary images in Meudon (ground-based)
  - Encyclopedia of Extra-Solar Planets (compilation of published data)
  - Atmospheric profiles of Titan (Cassini/CIRS)
  - IKS / Halley (Vega-1), M4ast (asteroid spectrosc.)
  - BaseCom (comets from Nançay), Jupiter radio observations (from Nançay)
  - Solar feature catalogues (from HELIO program)

  Projects at VO-Paris (from existing databases):

  TNO data compilation, VIRTIS/VEx & /Rosetta, mineral spectroscopy…

  Other services in development: Rome, Toulouse, Graz

- Other targeted data centres/services (with specific interfaces):

  AMDA (under test), ESO archive, GhoSST

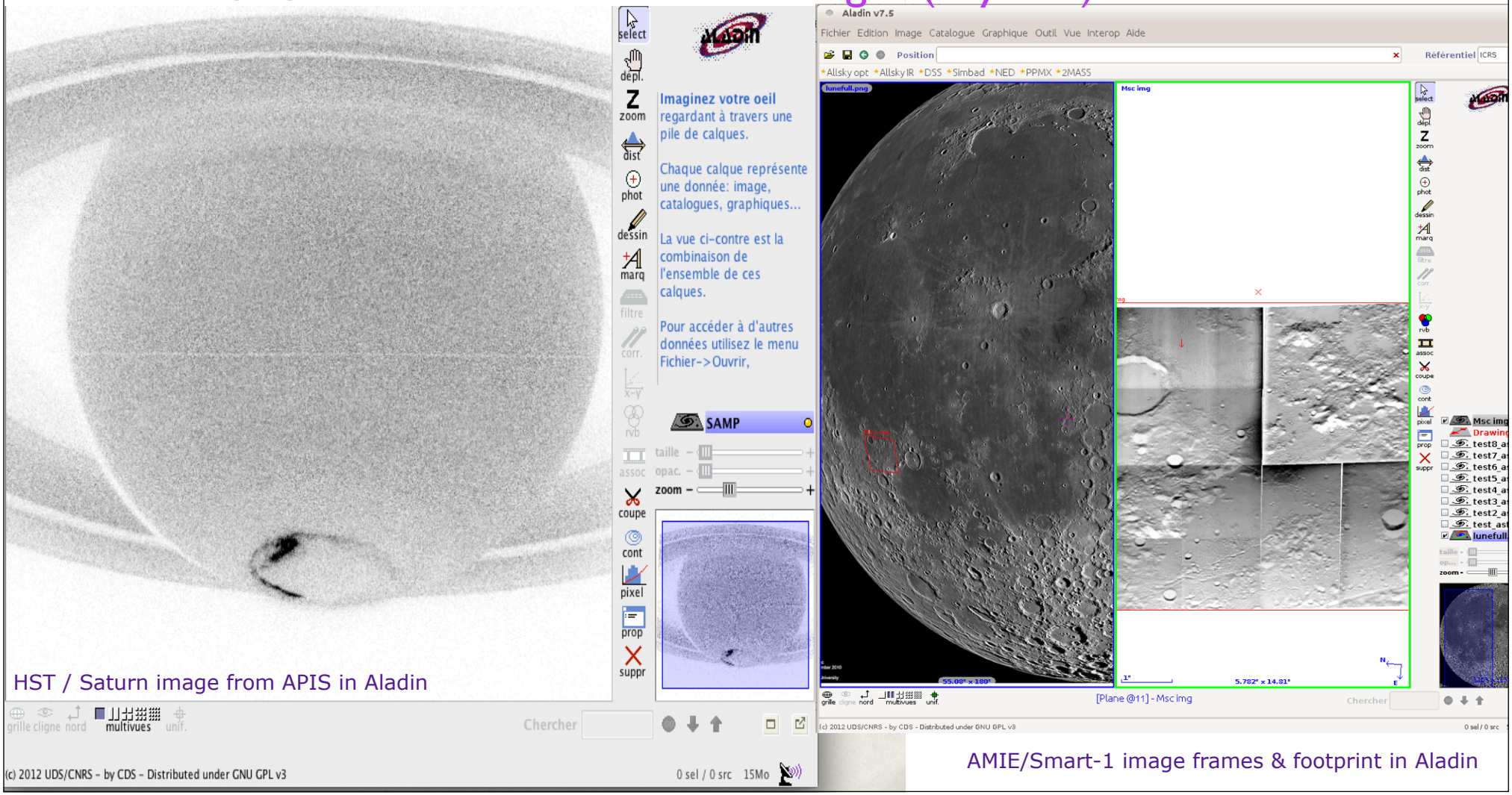
- Space data centres accessible by VESPA (via **PDAP**):

  PSA and DARTS (ESA & JAXA archives, with minimal interface)

Visualization tools: adapt IVOA tools

Aladin:

- plots images/cubes
- handles sky/spheroid coordinates
- can build image mosaics
- can handle object catalogs
- Solar System bodies tracking on sky images (SkyBoT)



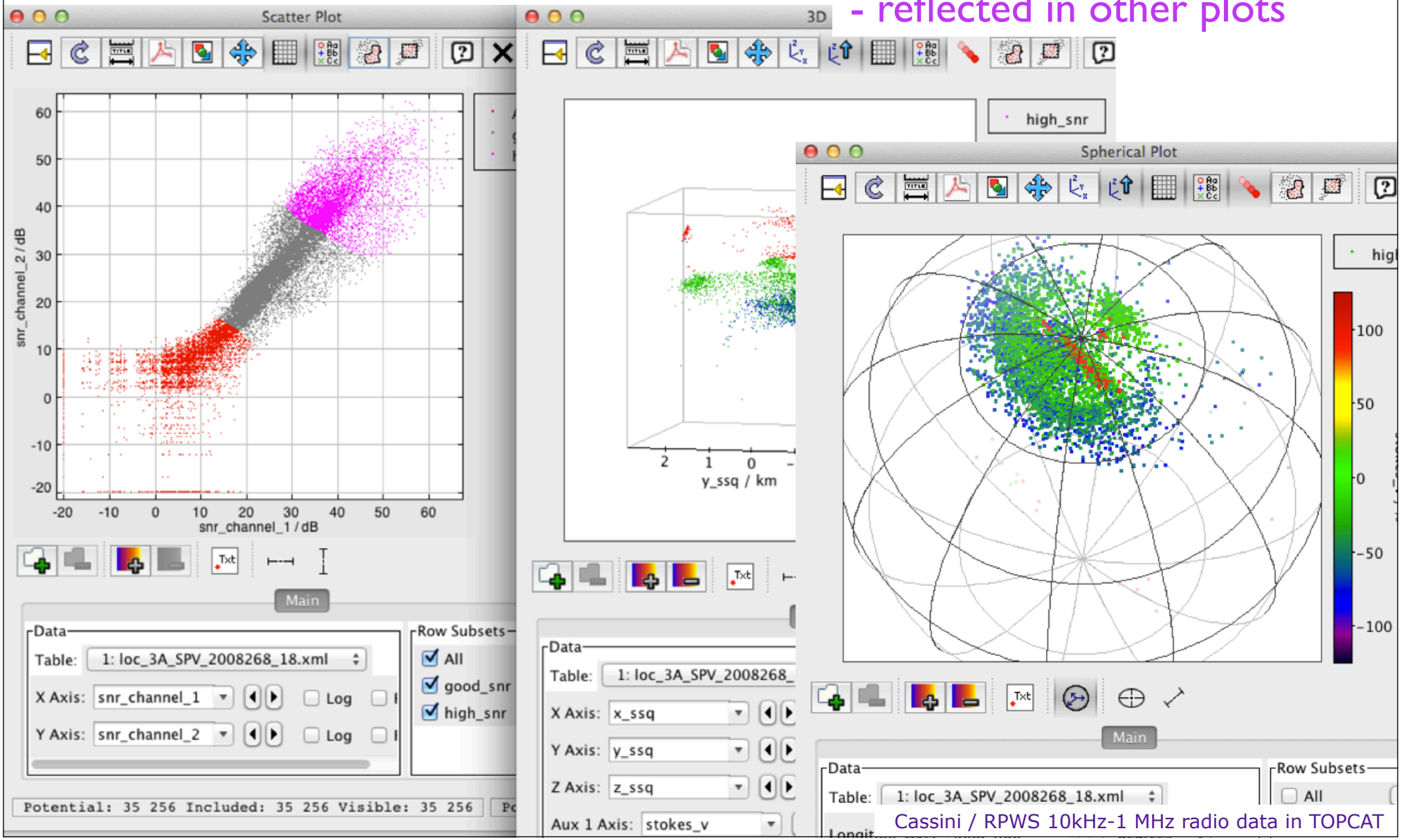
HST / Saturn image from APIS in Aladin

AMIE/Smart-1 image frames & footprint in Aladin

TOPCAT:

Allows data selection

- by formula or graphically
- reflected in other plots



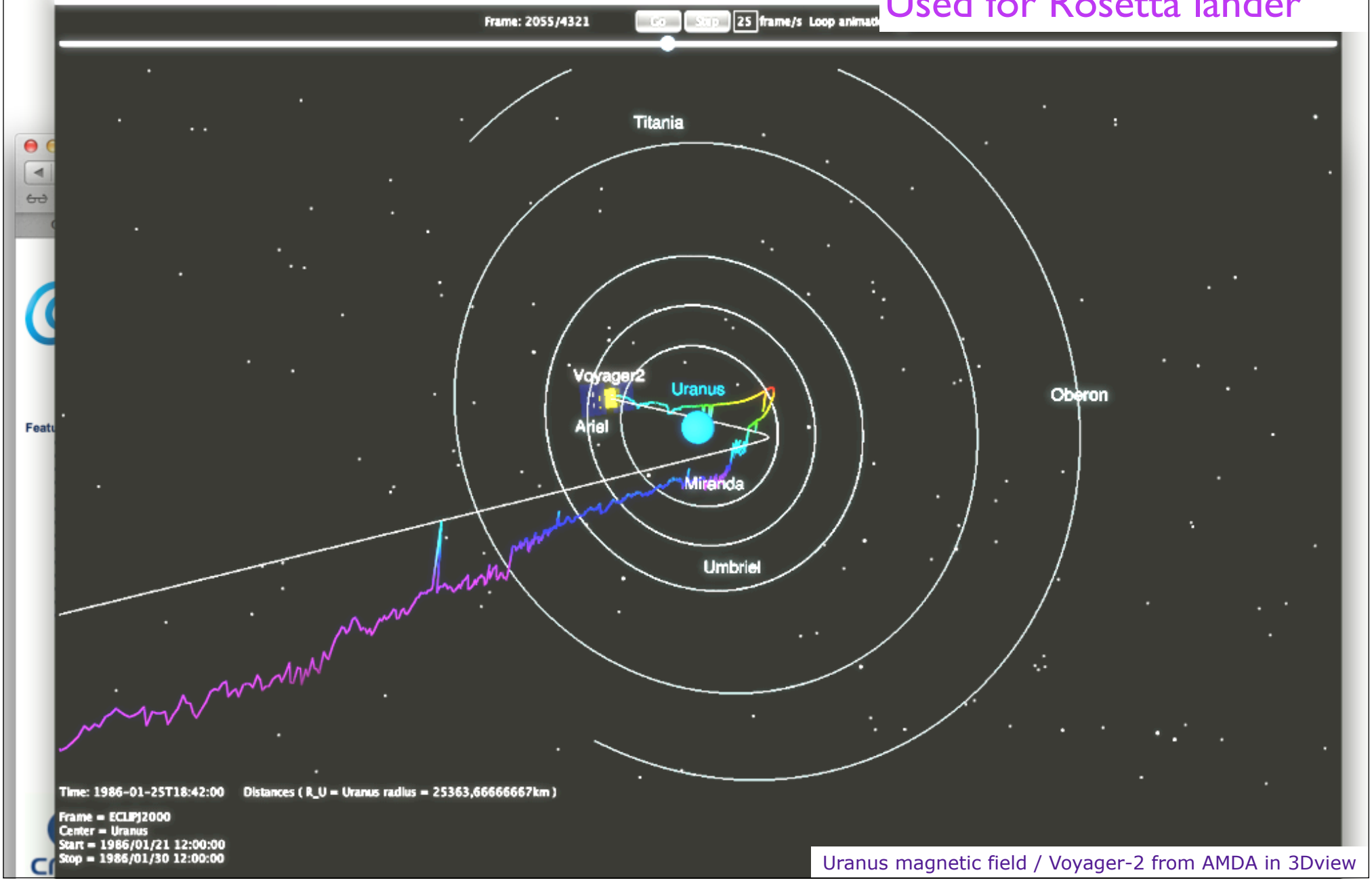
Cassini / RPWS 10kHz-1 MHz radio data in TOPCAT

Visualization tools: adapt other existing tools

3Dview / CNES:

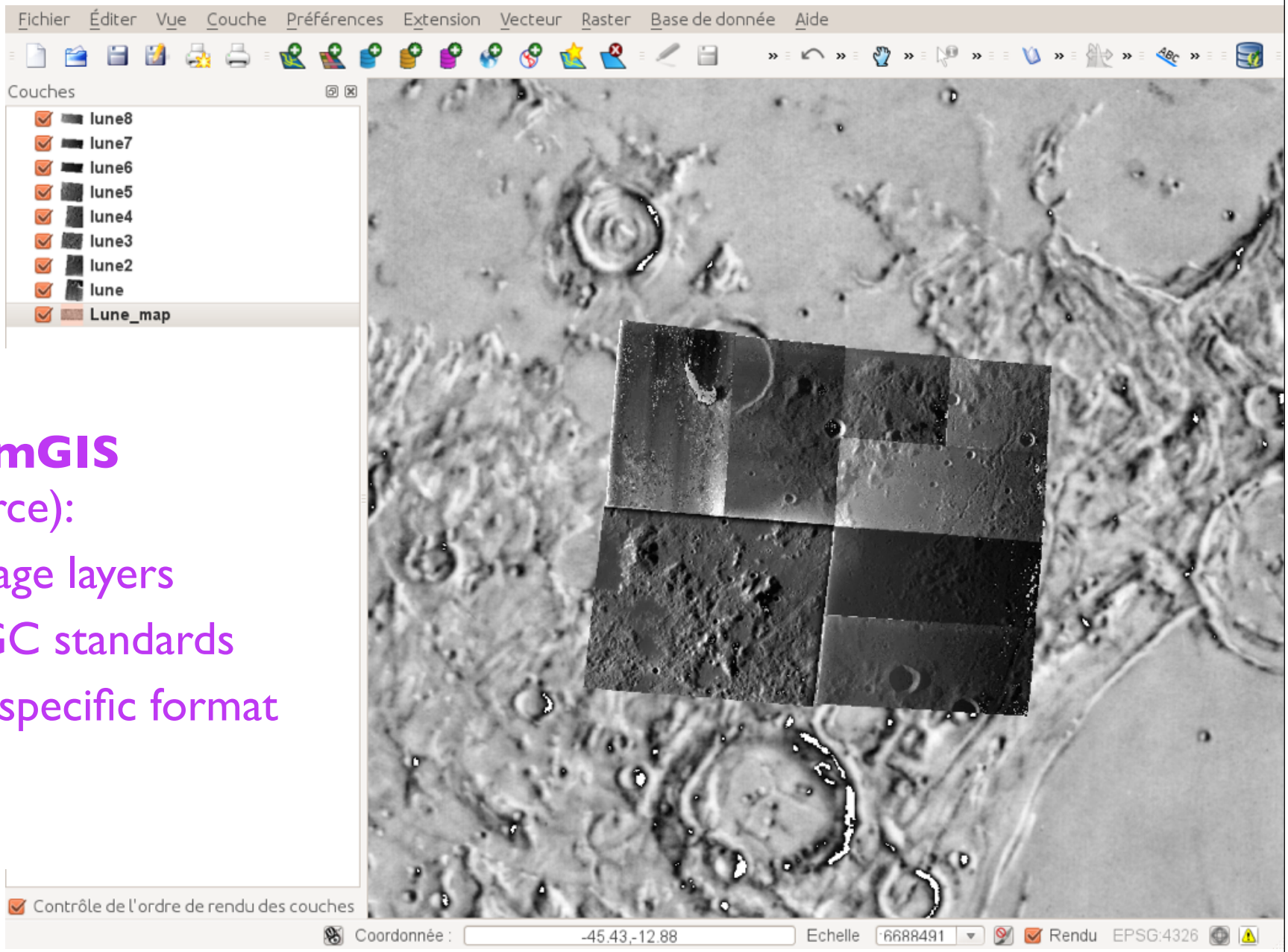
Spacecraft trajectories+data

Used for Rosetta lander



Uranus magnetic field / Voyager-2 from AMDA in 3Dview

Visualization tools: connect GIS (OGC standards)



QuantumGIS
(opensource):

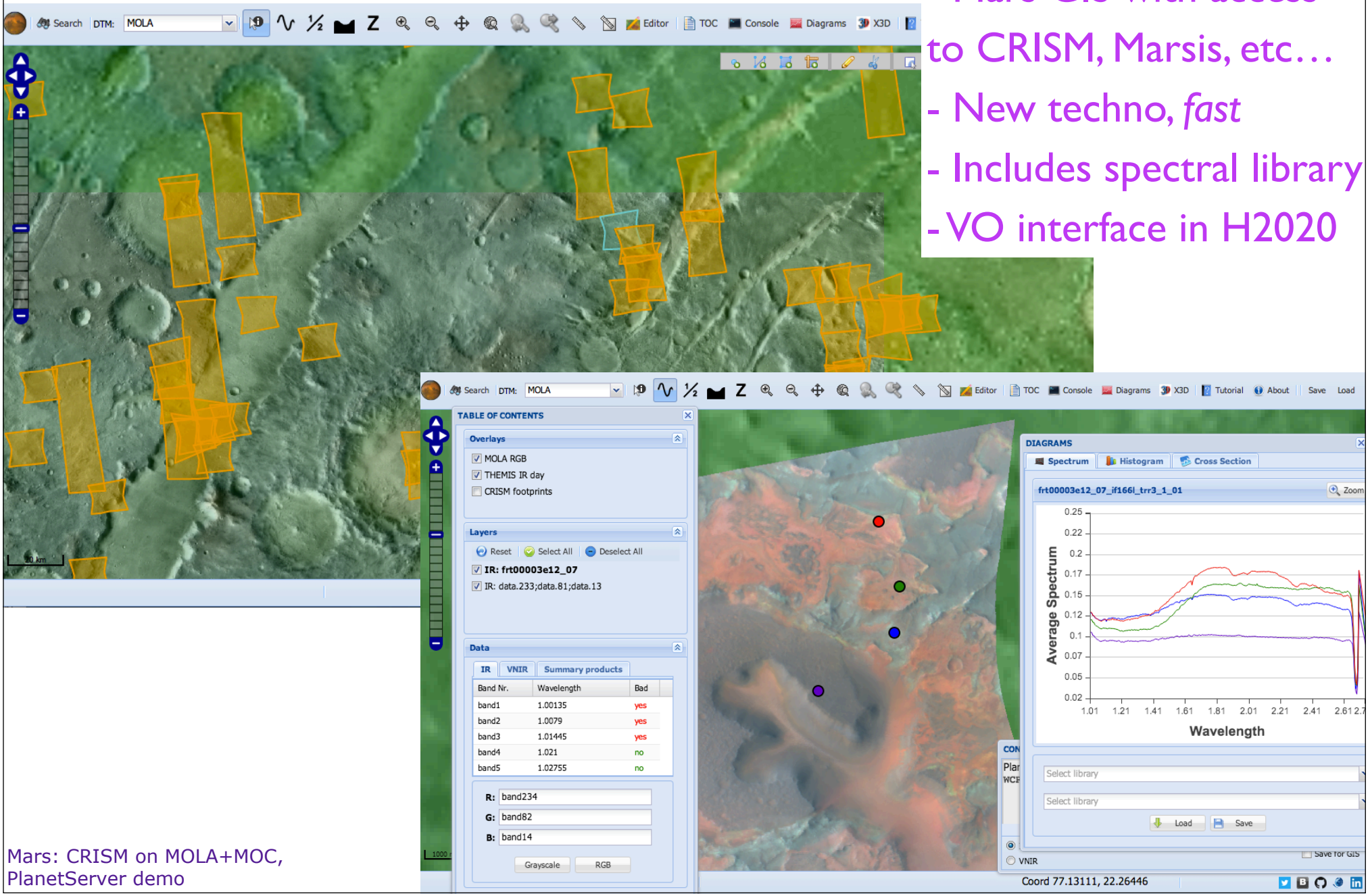
- plots image layers
- uses OGC standards
- expects specific format

AMIE/Smart-1 image frames on Clementine basemap in QuantumGIS

Visualization tools: connect GIS

PlanetServer:

- Mars GIS with access to CRISM, Marsis, etc…
- New techno, *fast*
- Includes spectral library
- VO interface in H2020



Mars: CRISM on MOLA+MOC, PlanetServer demo

Altogether

- Very efficient data mining & quick-look system
  - Planetary science supported from Europlanet developments
  - Based on IVOA standards & tools + IAU references
  - Some areas to be optimized in collaboration with IVOA / IPDA / IAU (e.g. description of coordinate systems)

- Science value increases with number of connected services
  - Related data services increase science coverage
  - Services can provide extra information on same objects (exoplanets), or same information on new objects (small bodies)
  - Need for reference laboratory data (e.g. mineral spectroscopy)
    + modeling (e.g. GCM)
    + ground support observations for space missions (Venus?)

- New data services to be implemented

=> Europlanet #3 pgr being set up for Horizon 2020 (2015-2019?)
  - Europlanet/IDIS package to evolve into a full VO activity: ***VESPA***
  - Coordination: VO-Paris - new objectives / partners / activities

Some objectives for H2020

- Increase number of data services
  - Handled by thematics
  - Link to large topical services (AMDA, GhoSST/SSHADE…)
  - + calls open to external partners
  - + some selected amateur resources
- Tools update + adaptation
  - Specific functions in Aladin / TOPCAT
  - Use 3Dview (or other…) to visualize asteroid/comet shape models?
  - VESPA client to be upgraded
- VO / GIS link
  - Includes use of FITS kw for planetary mapping
- Refine standards
  - Have EPN standards validated by IAU whenever relevant
  - ADQL update? (uppercase support required for target names…)
- Extra references
  - Complete list of observatories + viewing capacities
  - List of coordinate systems in the solar System
  - …

Extra information

http://voparis-europlanet.obspm.fr

EUROPLANET RI
Host Institute: Obs. de Paris
Search

DATA RESOURCES
- . Meteorites & lunar samples
- . Ices & minerals spectra
- . Ephemeris
- . Exoplanets

VO ARCHITECTURE
- . Technical docs
- . Use cases/Tutorials

SERVICES
- . VO demonstrators

TOOLS
- . Visualisation tools
- . Spaceborne Data

DATA
- . Data Access
- . External services
- . Local databases

You are here: Planetary Dynamics Node > Architecture

IDIS Tech. Node | Interiors & Surfaces Node | Atmospheres Node | Plasma Node | Small Bodies & Dust Node | Planet. Dynamics Node

A Virtual Observatory in Planetary Science

The following documents illustrate how to work with the planetary VO, based on real science cases.

Help / tutorials for VO users	
Name	**Comments**
TOPCAT & EPN data services	Using TOPCAT to browse EPN-TAP services
EPN client & TOPCAT	Searching and plotting atmospheric profiles

EPSC 2013 use cases (videos)	
Name	**Data services + Tools**
Planetary Virtual Observatory	Introduction
Auroral processes on Saturn	AMDA & APIS + Aladin & EPN client
Exploring exoplanets	Encyclopedia of exoplanets + EPN client & TOPCAT
Tracking asteroids	Asteroid database + Aladin & SkyBoT
Martian environment	AMDA & LatHyS + TOPCAT
Oxygen ions plume on Mars	AMDA & LatHyS + 3DView & TOPCAT
Pluto surface	Observational spectra + GhoSST

PSA use case:
how to add value to a PDS archive?

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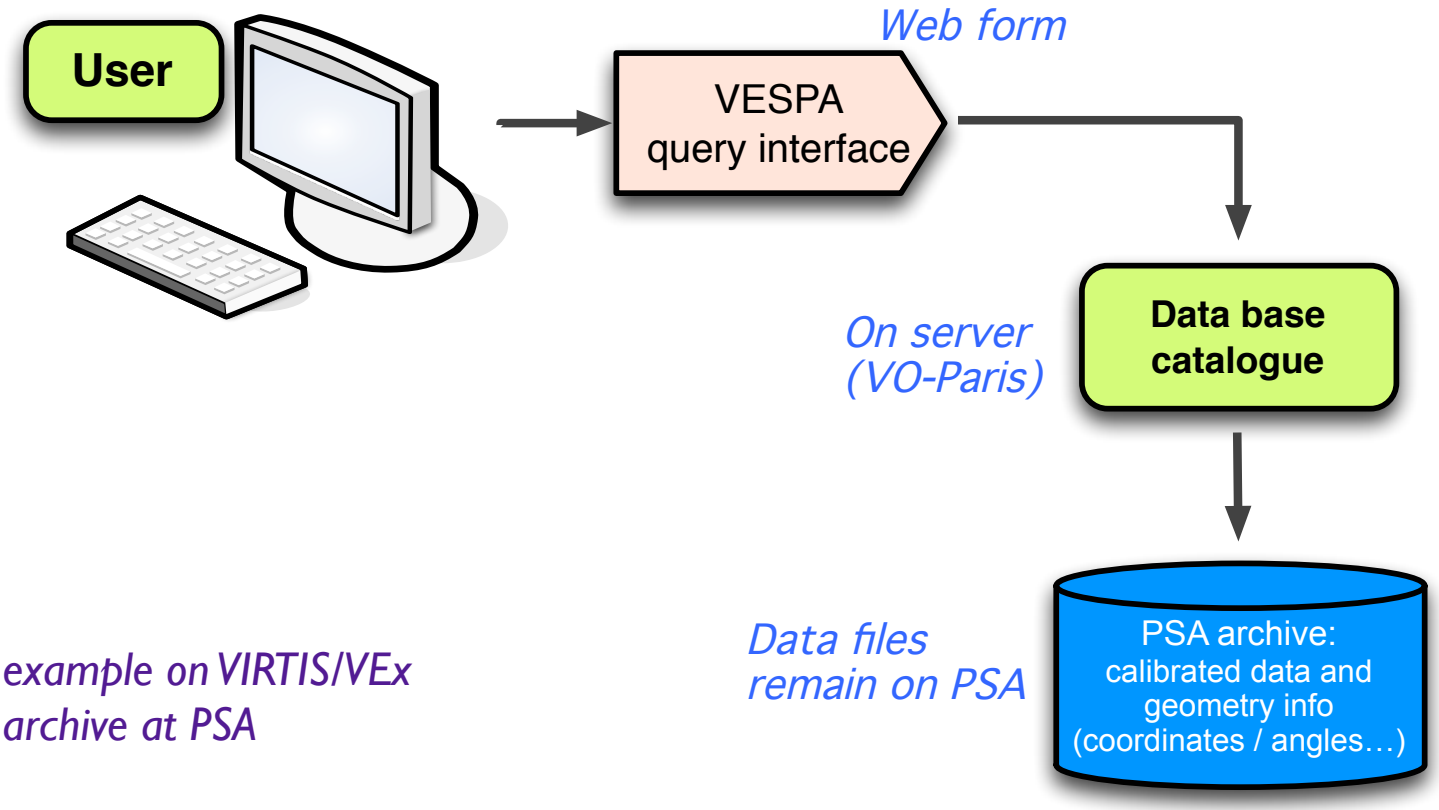
Add search function in a PDS dataset

Archive file VIRTIS_INDEX.TAB => service catalogue in database

All files/sessions are described using:
- UTC / location / local time / tangent altitude
- Instrument parameters (including integration time / quality code)

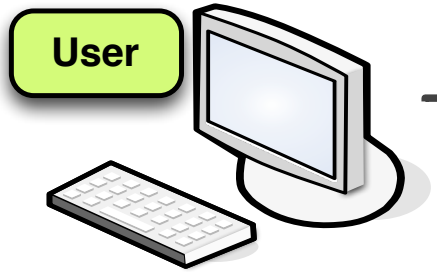
VESPA can use those as search parameters



example on VIRTIS/VEx archive at PSA

VIRTIS / Venus-Express Data Fuzzy-Center:

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



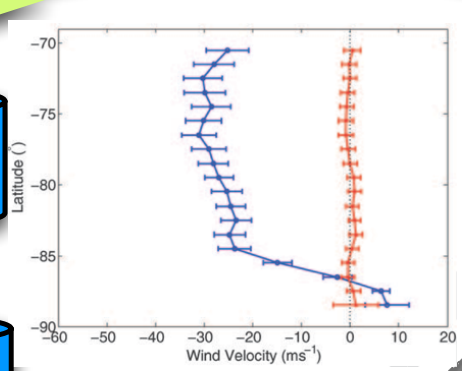
VESPA Client

PI inst. service (LESIA, IAPS)

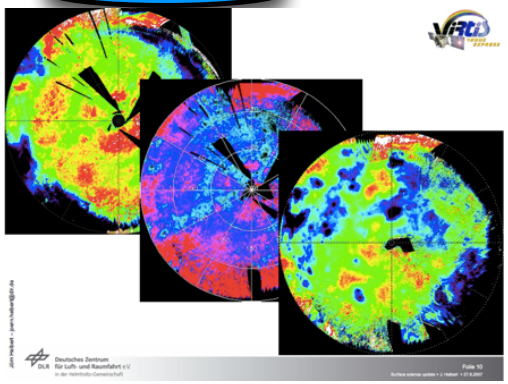
Data base catalogue

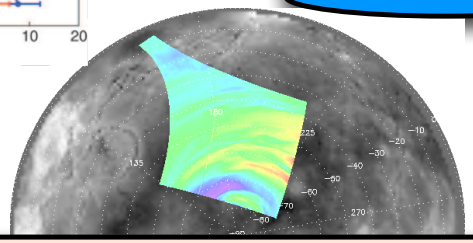
Primary Data base: calibrated data and geometry info (coordinates / angles…)

Secondary DB: wind maps



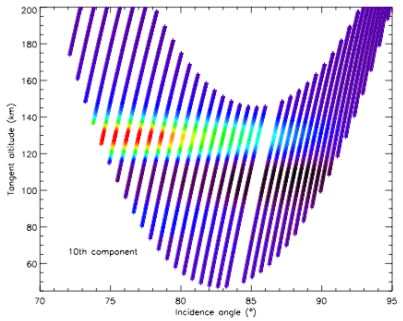
Secondary DB: surface maps



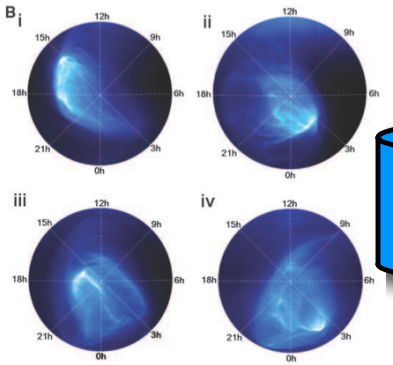


secondary services in col institutes (Bilbao, Berlin, Lisboa, Oxford…)

…or one service linking data products in cols institutes



Secondary DB: Limb composition



Secondary DB: Atmosphere dynamics

Titan Use case

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Titan profiles database

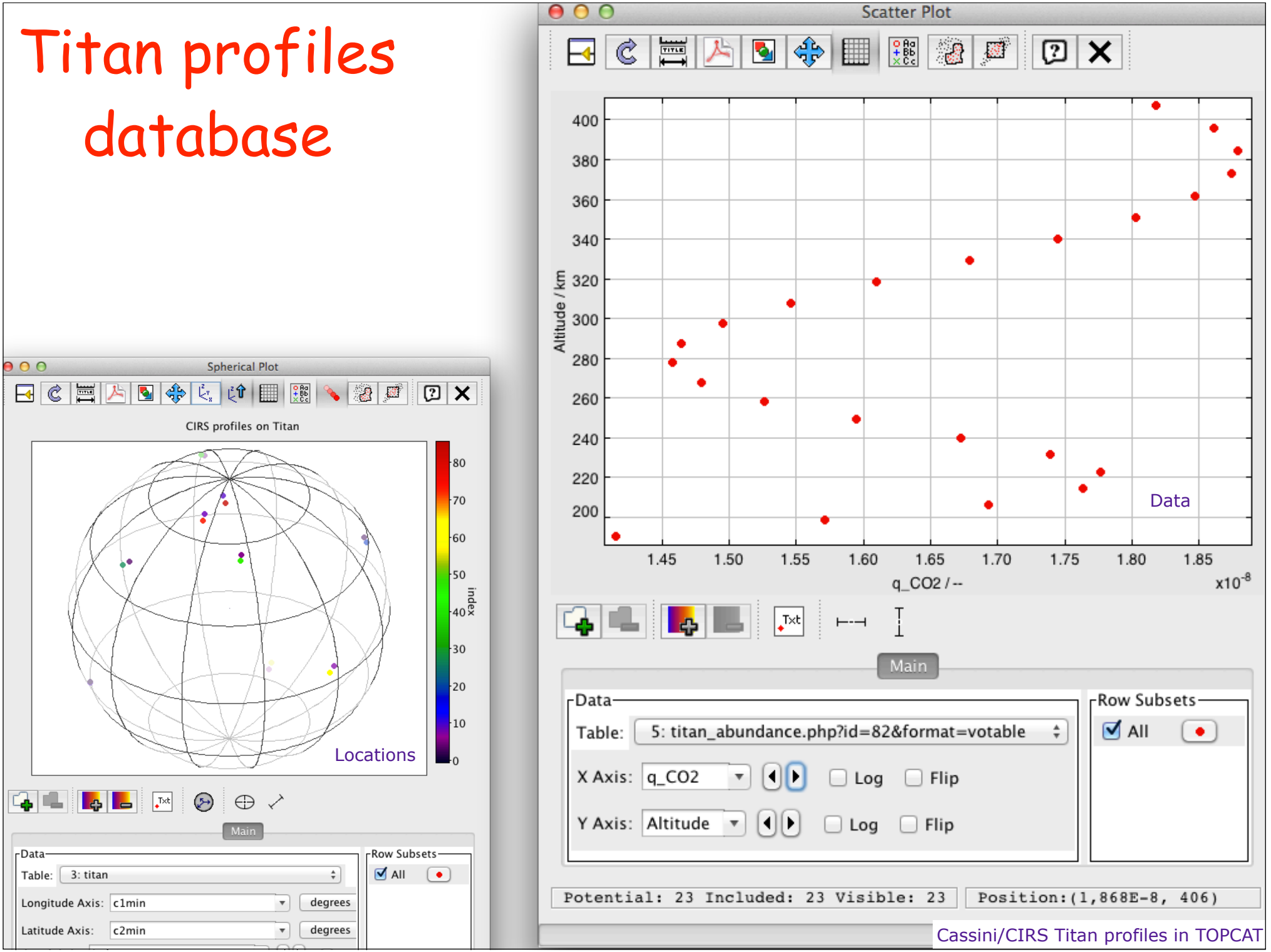
Typical example of VO data service

- Data from CIRS / Cassini, outcome of a publication
- P, T and gaz abundance profiles retrieved from spectral inversion in mid-atm
- Currently 93 profiles published
- Some 100s profiles to be added in 2014 from another publication
- Main parameters are : location, time, local time, season…

See recorded tutorial/demo here:

http://voparis-europlanet.obspm.fr/utilities/Tuto_Titan_TopCat.pdf

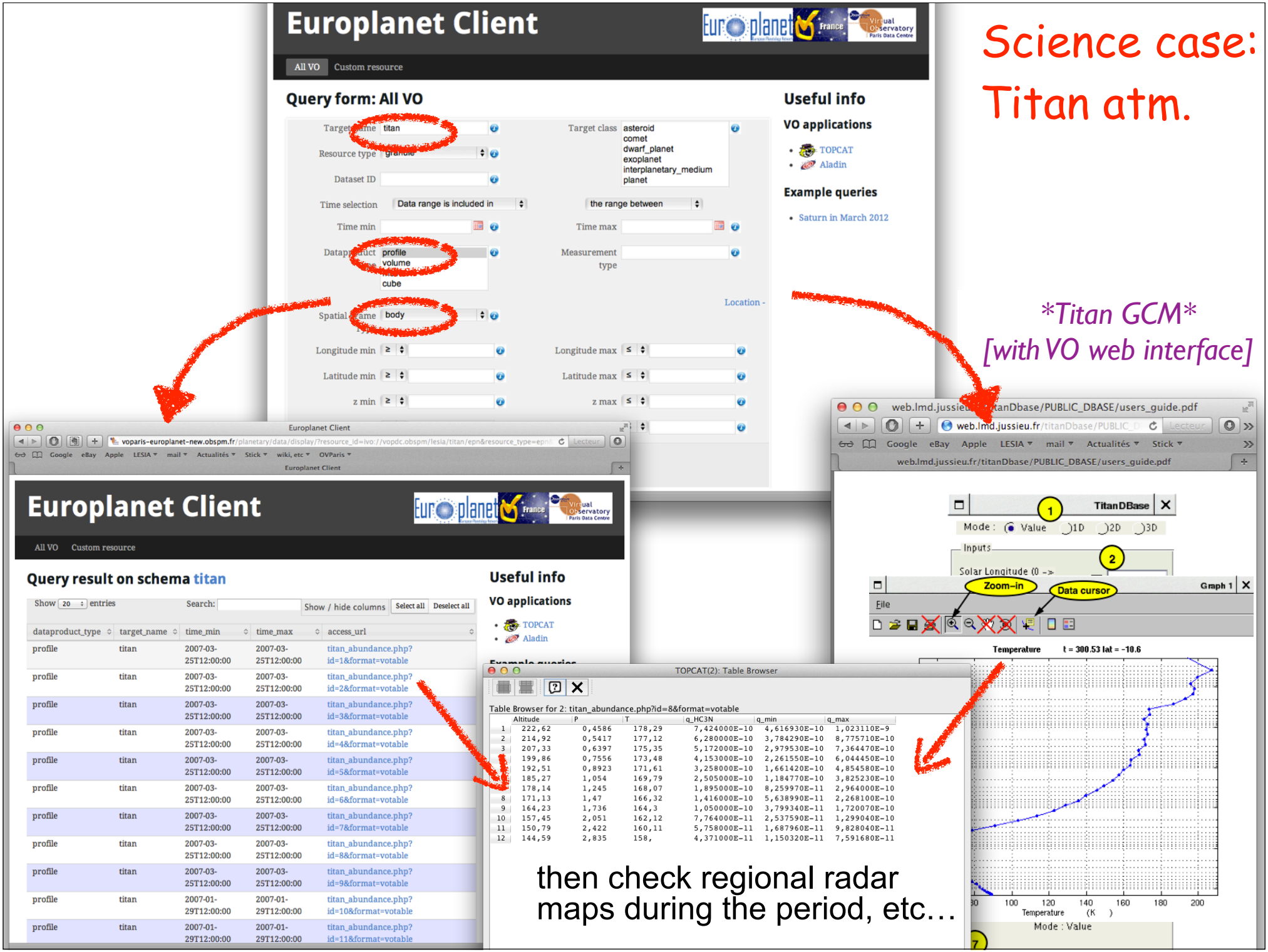
Titan profiles database



Cassini/CIRS Titan profiles in TOPCAT

Science case: Titan atm.

Titan GCM
[with VO web interface]



then check regional radar maps during the period, etc…