

A Planetary Science Virtual Observatory prototype (Europlanet-H2020 project)

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+ Many contributions from
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etc

Planetary Science VO — Objectives in EPN-RI (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

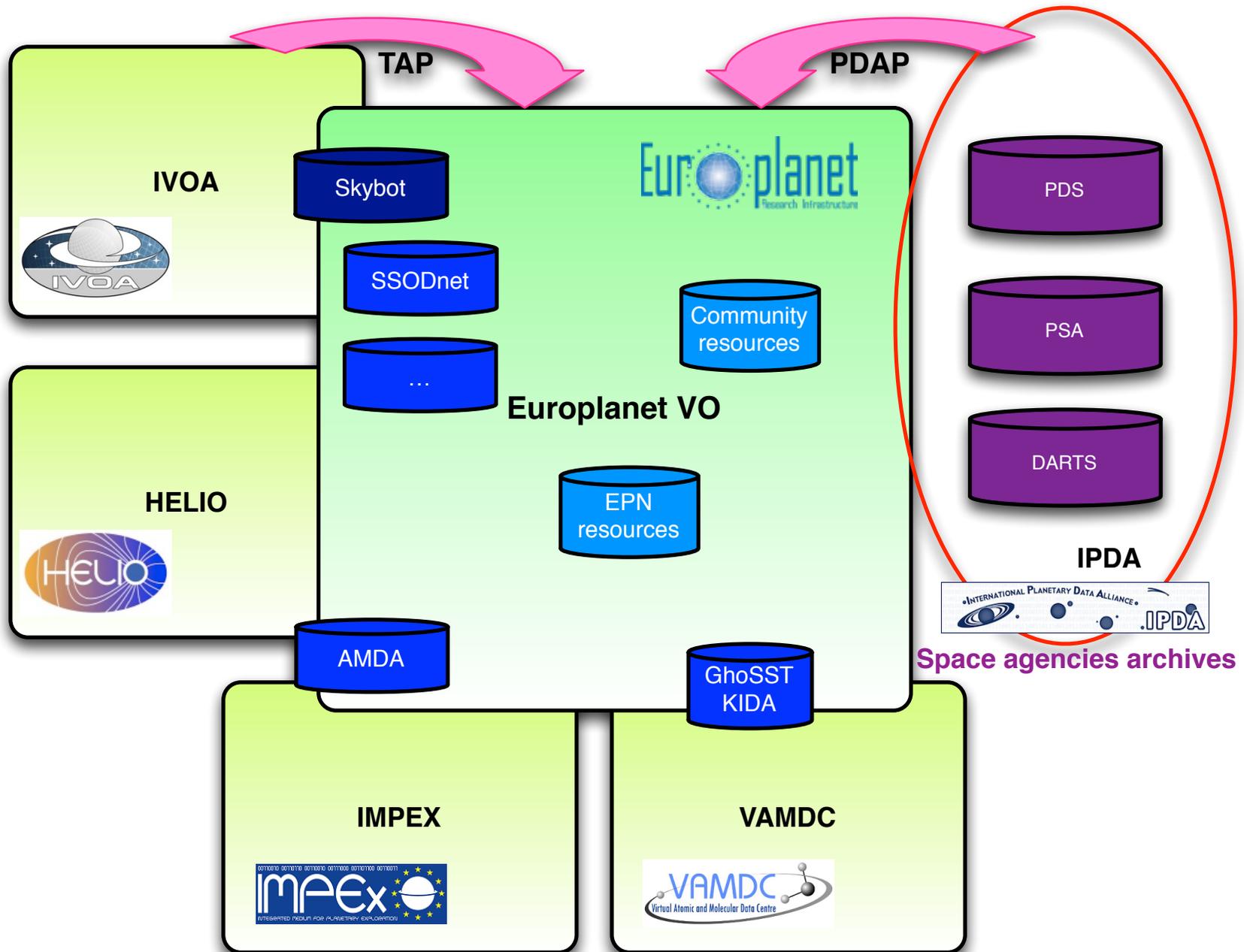
- Make "small" derived data sets accessible
- Develop specific processing/visualisation tools

Contributions by external users

Constraint: minimise developments

Success: the user doesn't see the infrastructure

International & thematic context



Client(s) / access

- Client application, public version is on-line
- Supports EPN-TAP + PDAP

<http://voparis-europlanet-new.obspm.fr/>

Europlanet Client

All VO Custom resource

Query form: all VO

Target name

Resource type

T min

Dataproduct type

Useful info

Europlanet Client

All VO Custom resource

Query results

Auroral planetary imaging and spectroscopy

RESULTS: [SAMP](#) [VOTABLE](#) [HTML](#)

Planetary aurorae are powerful emissions radiated from auroral regions of magnetized planets by accelerated charged particles, in a wide range of wavelengths (from radio to X-rays). The UV range in particular is adequate to measure collisionally excited transitions of H and H₂, the dominant species in the upper atmosphere of giant planets, produced by precipitating auroral particles, and benefits a good angular resolution. Auroral UV observations therefore provide a rich source of informations on planetary atmospheres and magnetospheres. They also offer a unique diagnostic to remotely probe the solar wind activity throughout the heliosphere..

Copyright notice: this research have been made using APIS database by LaurentLamy Lesia-Observatoire de Paris

August onboard Phobos2, atmospheric composition of mars

RESULTS: [SAMP](#) [VOTABLE](#) [HTML](#)

<No resource description provided>

Useful info

VO applications

-  TOPCAT
-  Aladin

Example queries

- [Jupiter in January 2004](#)

- **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-I)
- BaseCom (comets from Nançay — under test)
- under test: Jupiter radio observations (from Nançay), M4ast (asteroid spectrosc.)

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, KIDA, GhoSST

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

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

Europlanet Client

voparis-europlanet-new.obspm.fr/planetary/data/epn/query/submit/all/

and magnetospheres. They also offer a unique diagnostic to remotely probe the solar wind activity throughout the heliosphere.
Copyright notice: VO-Paris Data Centre - LESIA

INAF-IAPS RDB NASA dust catalogue TAP service

Results : 0
[DISPLAY RESULTS](#) [DISPLAY VOTABLE](#) [SAMP VOTABLE](#) [ADVANCED QUERY FORM](#)

The Cosmic dust catalog is an internal resource of the SBDN, since we have internally developed original services to access this catalogs. NASA's Cosmic dust catalog 15 and 18 have been joined to obtain this service. 467 (from catalog 15) plus 957 (from catalog 18) dust grains with their main characteristics, images and X-ray spectra are listed. Not only cosmic dust particles are listed, but also terrestrial contamination (natural), terrestrial contamination (artificial) and aluminium oxide spheres.
Copyright notice: IA2

Generated WHERE clause of ADQL statement:

```
SELECT * FROM ... WHERE target_name LIKE '%saturn%' AND resource_type = 'granule'
```

PDAP Resources

PSA
Results : 1481
[DISPLAY RESULTS](#) [DISPLAY VOTABLE](#) [SAMP VOTABLE](#)

DARTS
Results : 154
[DISPLAY RESULTS](#) [DISPLAY VOTABLE](#) [SAMP VOTABLE](#)

Generated PDAP request:

```
TARGET_NAME=SATURN&RESOURCE_CLASS=PRODUCT
```

© Paris Observatory 2012 – Layout based on YAML

Waiting for PDAP finalisation

PSA Archive InterOperability System (PAIO) v3.5.1

PAIO Home
[PAIO Login/Logout](#)
[PAIO Metadata Query](#)
[PAIO Data Request](#)
[PAIO Users Manual](#)
[PAIO Client files](#)

PSA Home
[Contact PSA HelpDesk](#)

Username: AIOURL

PSA InterOperability pages (PAIO)

Planetary Science Archive
 European Space Agency

The Planetary Science Archive METADATA Query Service

Search Result (9 Data Sets found)

Page 1 of 1

FTP	Files	DATA_SET_ID	DATA_SET_NAME	PRODUCTS	INSTRUMENT_ID	TARGET_NAME	START_TIME	STOP_TIME
FTP	XML/Tree	HP-SSA-ACP-3-DESCENT-V1.0	HUYGENS ACP CALIBRATED ENGINEERING & SCIENCE DATA	19	ACP,GCMS	TITAN	2005-01-14 09:11:01.678666666	2005-01-14 11:00:05.428666666
FTP	XML/Tree	HP-SSA-DISR-23-EDR/RDR-V1.0	HUYGENS PROBE DISR RESULTS V1.0	5698	DISR	TITAN	2005-01-14 09:11:41.0	2005-01-14 12:49:07.0
FTP	XML/Tree	HP-SSA-DTWG-6-TRAJECTORY-V1.0	HUYGENS TRAJECTORY	7	DTWG	TITAN	2005-01-14 09:05:52.523333333	2005-01-14 11:38:10.77
FTP	XML/Tree	HP-SSA-DTWG-2-TRAJECTORY-V2.0	HUYGENS TRAJECTORY	7	DTWG	TITAN	2005-01-14 09:05:52.523333333	2005-01-14 11:38:10.77
FTP	XML/Tree	HP-SSA-DWE-2-3-DESCENT-V1.0	HUYGENS PROBE DWE RESULTS V1.0	3	DWE	TITAN	2005-01-14 10:19:27.0	2005-01-14 15:52:46.5
FTP	XML/Tree	HP-SSA-GCMS-3-FCODESCENT-V1.0	HUYGENS TITAN GAS CHROMATOGRAPH MASS SPEC 3 DESCENT V1.0	1591	GCMS	TITAN	1970-01-01 00:00:01.0	1970-01-01 00:00:01.0
FTP	XML/Tree	HP-SSA-HASI-2-3-4-MISSION-V1.1	HUYGENS HASI MISSION RAW AND CALIBRATED DATA V1.1	118	HASI	TITAN	2005-01-14 09:01:17.453333333	2005-01-14 12:10:20.828666666
FTP	XML/Tree	HP-SSA-HK-23-V1.0	HUYGENS ENGINEERING DATA	217	HUYGENS_HK	TITAN	2005-01-14 09:04:58.173333333	2005-01-14 12:41:29.13
FTP	XML/Tree	HP-SSA-SSP-34-DESCENT-V1.0	HUYGENS ENTRY, DESCENT AND SURFACE DATA	16	SSP	TITAN	2005-01-14 09:10:21.0	2005-01-14 12:47:46.993333333

Total 9 Data Sets

RETURN_TYPE = HTML
 RESOURCE_CLASS = PRODUCT

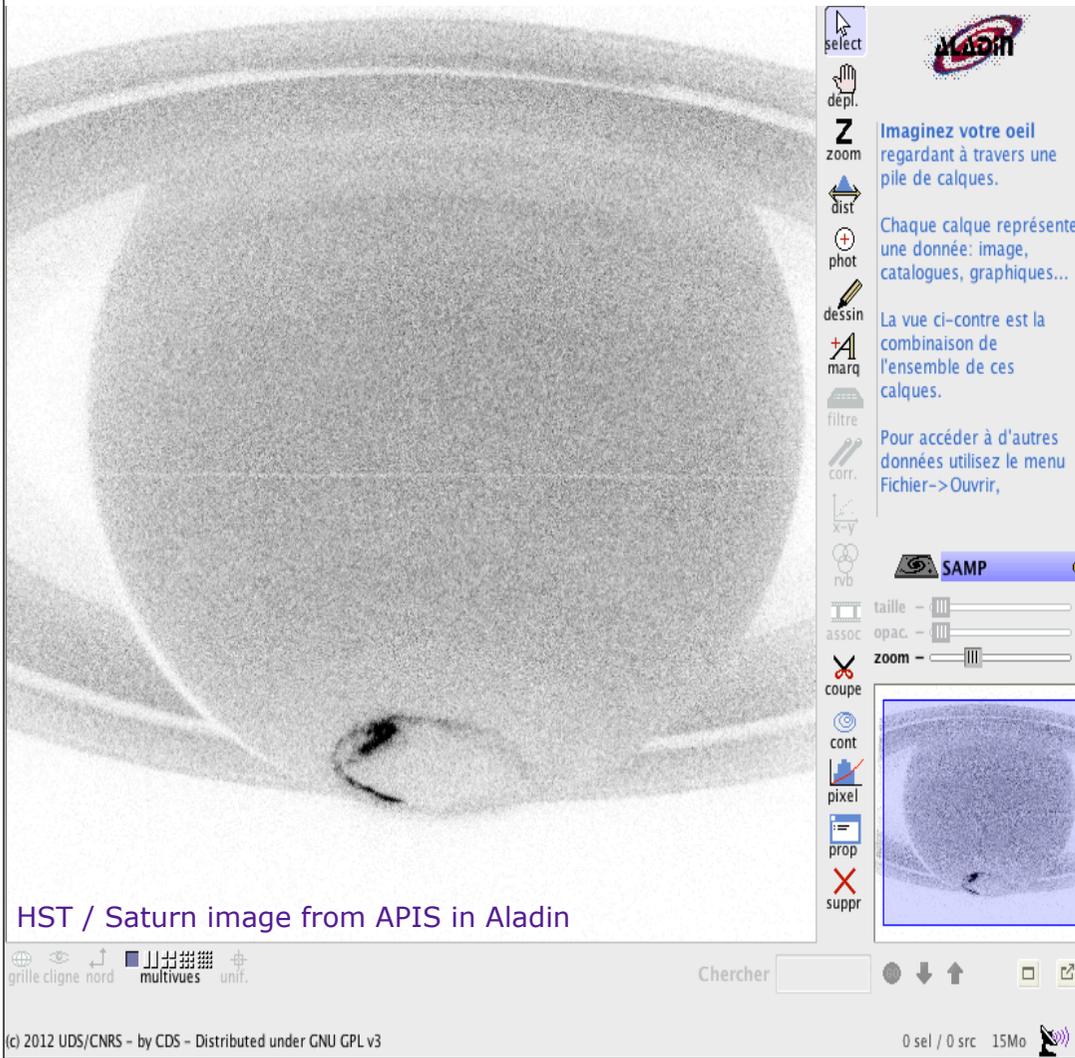
Hit Results (Products : 5 records)

No	DATA_SET_ID	PRODUCT_ID	MISSION_NAME	TARGET_NAME	START_TIME	STOP_TIME	ICON_ACCESS_REFERENCE
1	HAY-A-AMICA-3-HAYAMICA-V1.0	ST_0515848228_b.fits	MUSES-C	MARS	2003-11-11 12:45:10.000	2003-11-11 12:45:10.000	
2	HAY-A-AMICA-3-HAYAMICA-V1.0	ST_0515850188_w.fits	MUSES-C	MARS	2003-11-11 12:46:57.000	2003-11-11 12:46:57.000	

Visualization tools: IVOA

Aladin:

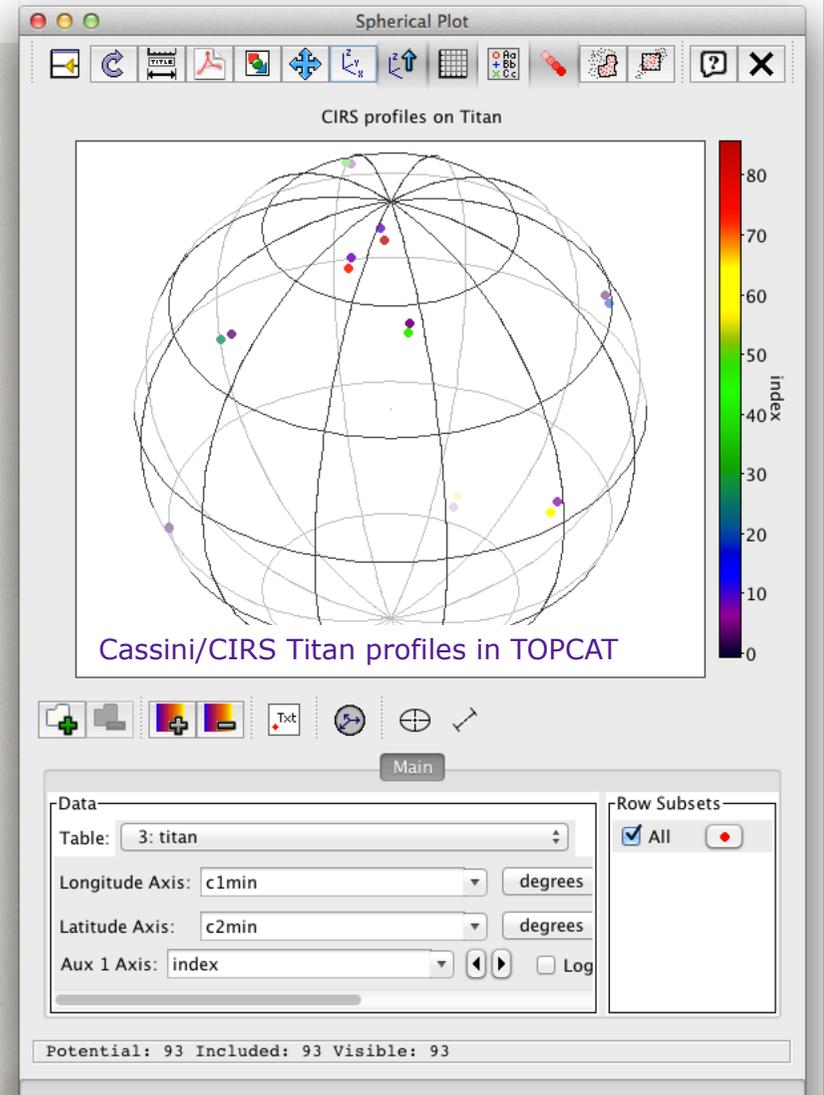
- plots images/cubes
- handles sky/spheroid coordinates



The screenshot shows the Aladin software interface. The main window displays a large, grainy image of Saturn from the Hubble Space Telescope (HST) taken by the APIS instrument. To the right of the image is a vertical toolbar with various icons for navigation and manipulation, such as 'select', 'depl.', 'zoom', 'dist', 'phot', 'dessin', 'marq', 'filtre', 'corr.', 'rvb', 'taille', 'assoc', 'zoom', 'coupe', 'cont', 'pixel', 'prop', and 'suppr'. Below the toolbar, there is a smaller inset window showing a zoomed-in view of a portion of the Saturn image. At the bottom of the interface, there is a search bar labeled 'Chercher' and a status bar showing '0 sel / 0 src 15Mo'. The text 'HST / Saturn image from APIS in Aladin' is visible at the bottom left of the image area.

TOPCAT:

- Handles tables
- 2D/3D plots



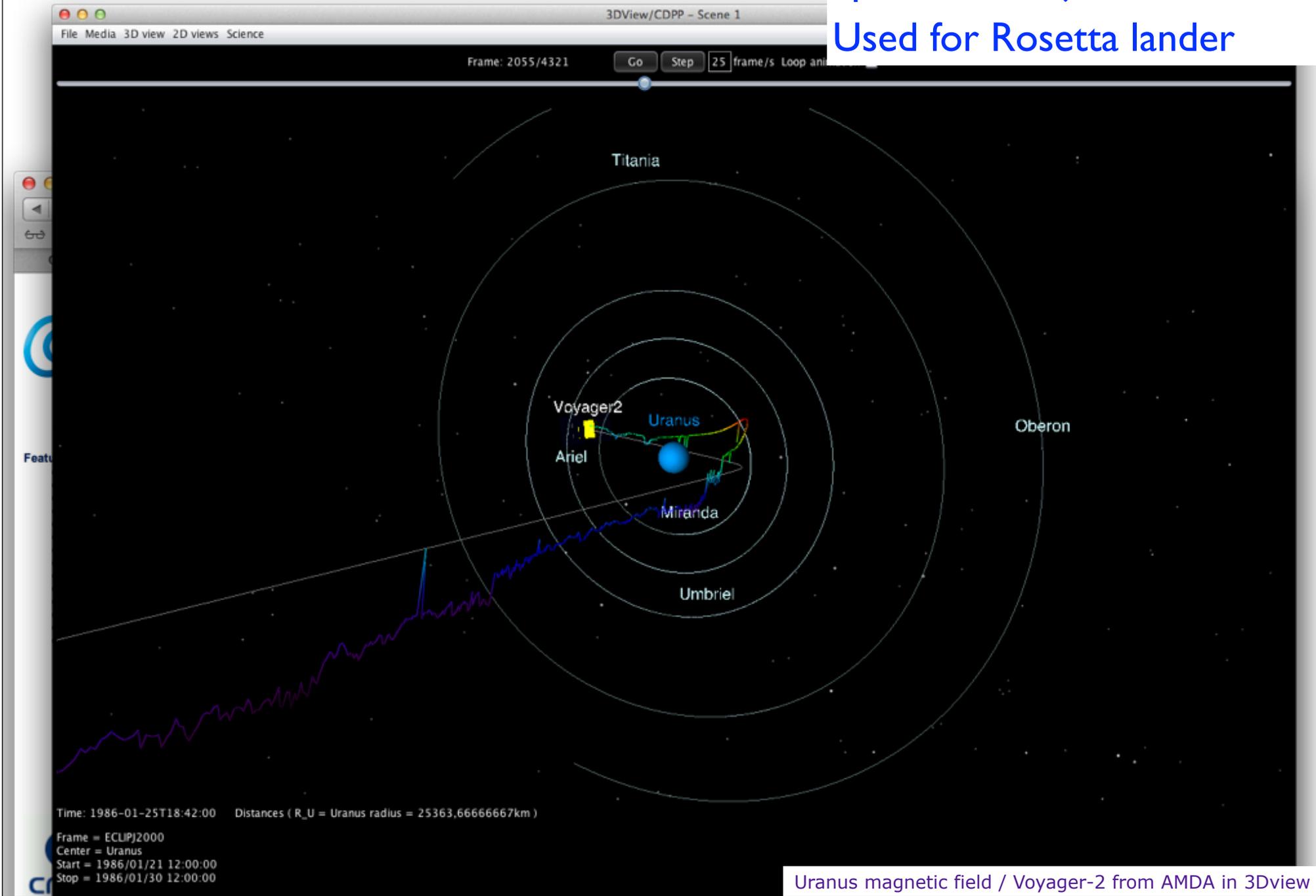
The screenshot shows the TOPCAT software interface. The main window is titled 'Spherical Plot' and displays a 3D spherical plot of Cassini/CIRS Titan profiles. The plot is a wireframe sphere with several colored dots (red, purple, green, yellow) scattered across its surface. A vertical color scale on the right side of the plot is labeled 'Index' and ranges from 0 to 80, with colors transitioning from purple at the bottom to red at the top. Below the plot, there is a control panel with various icons and a 'Main' button. The 'Data' section shows 'Table: 3: titan' and 'Longitude Axis: c1min degrees', 'Latitude Axis: c2min degrees', and 'Aux 1 Axis: index'. The 'Row Subsets' section has a checkbox for 'All' which is checked. At the bottom, a status bar shows 'Potential: 93 Included: 93 Visible: 93'. The text 'Cassini/CIRS Titan profiles in TOPCAT' is visible below the plot.

Visualization tools: others

3Dview / CNES:

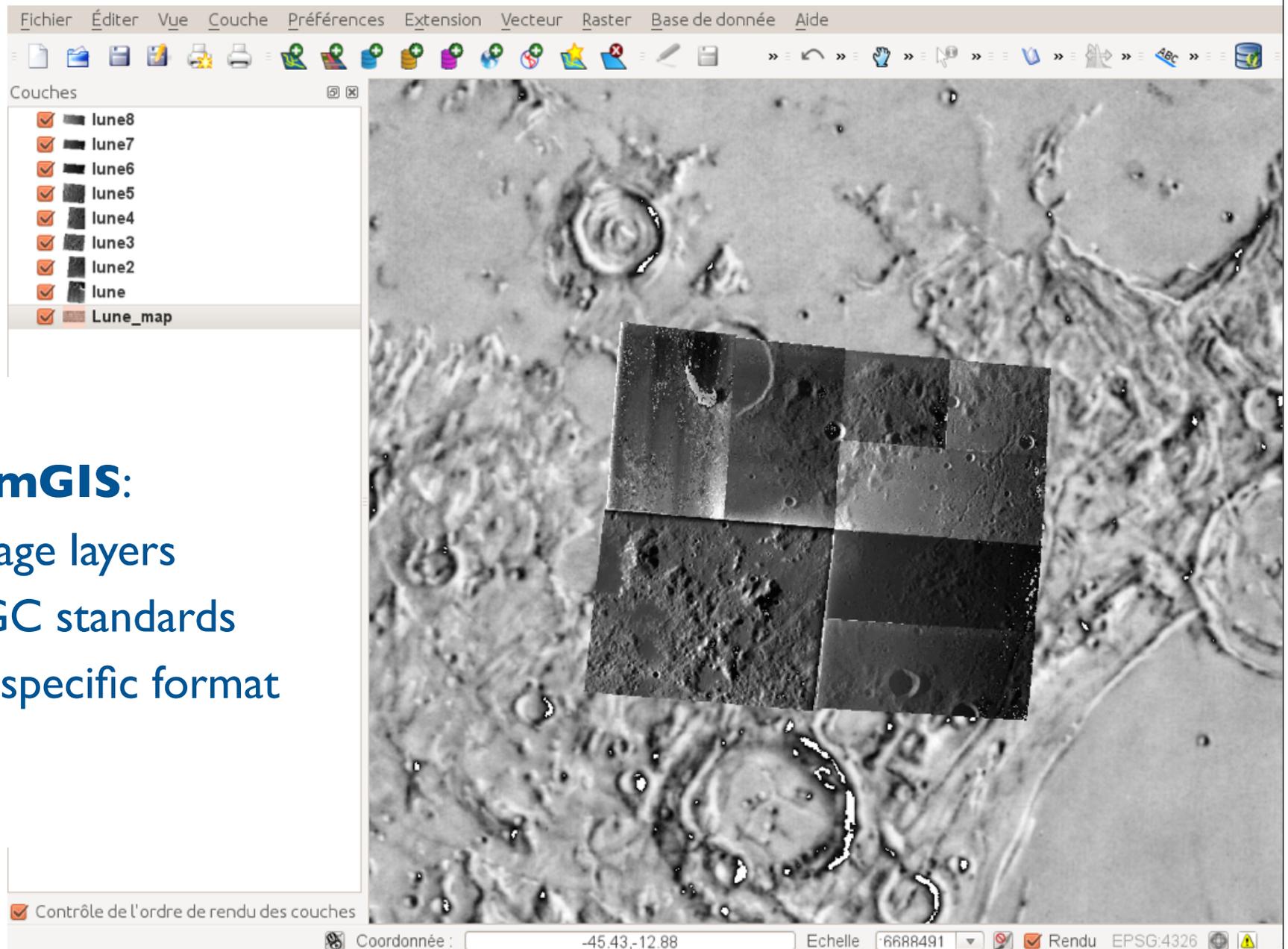
Spacecraft trajectories + data

Used for Rosetta lander



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

Visualization tools: GIS (OGC standards)



QuantumGIS:

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

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)

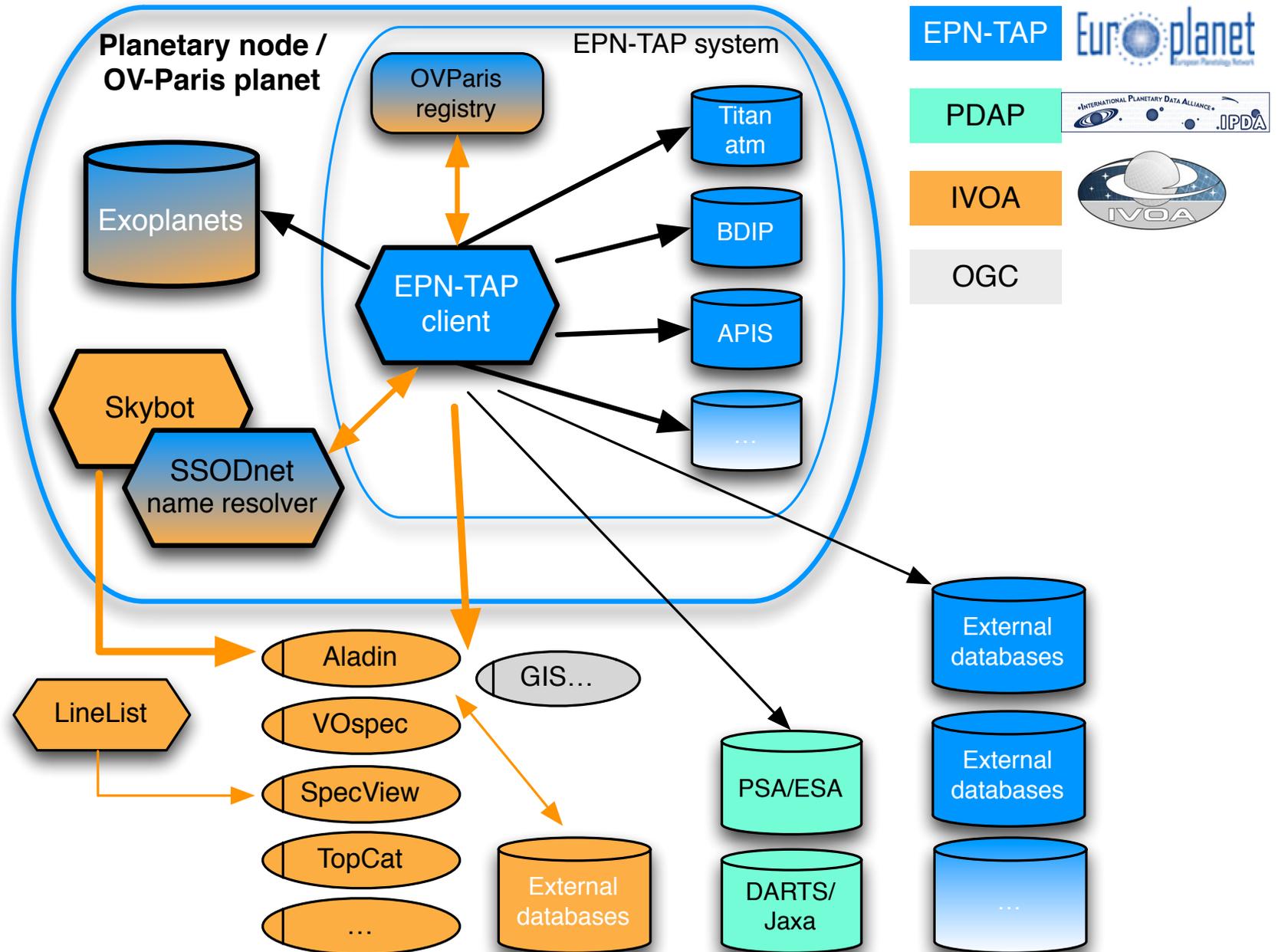
+ modeling (e.g. GCM)

+ ground support observations for space missions (Venus?)

- Currently in basic form => new data services to be implemented

Architecture: VOParis-centric view

(but it doesn't have to be that way)



IVOA loan standards

LEVEL 2
All standards

USERS



COMPUTERS

REC

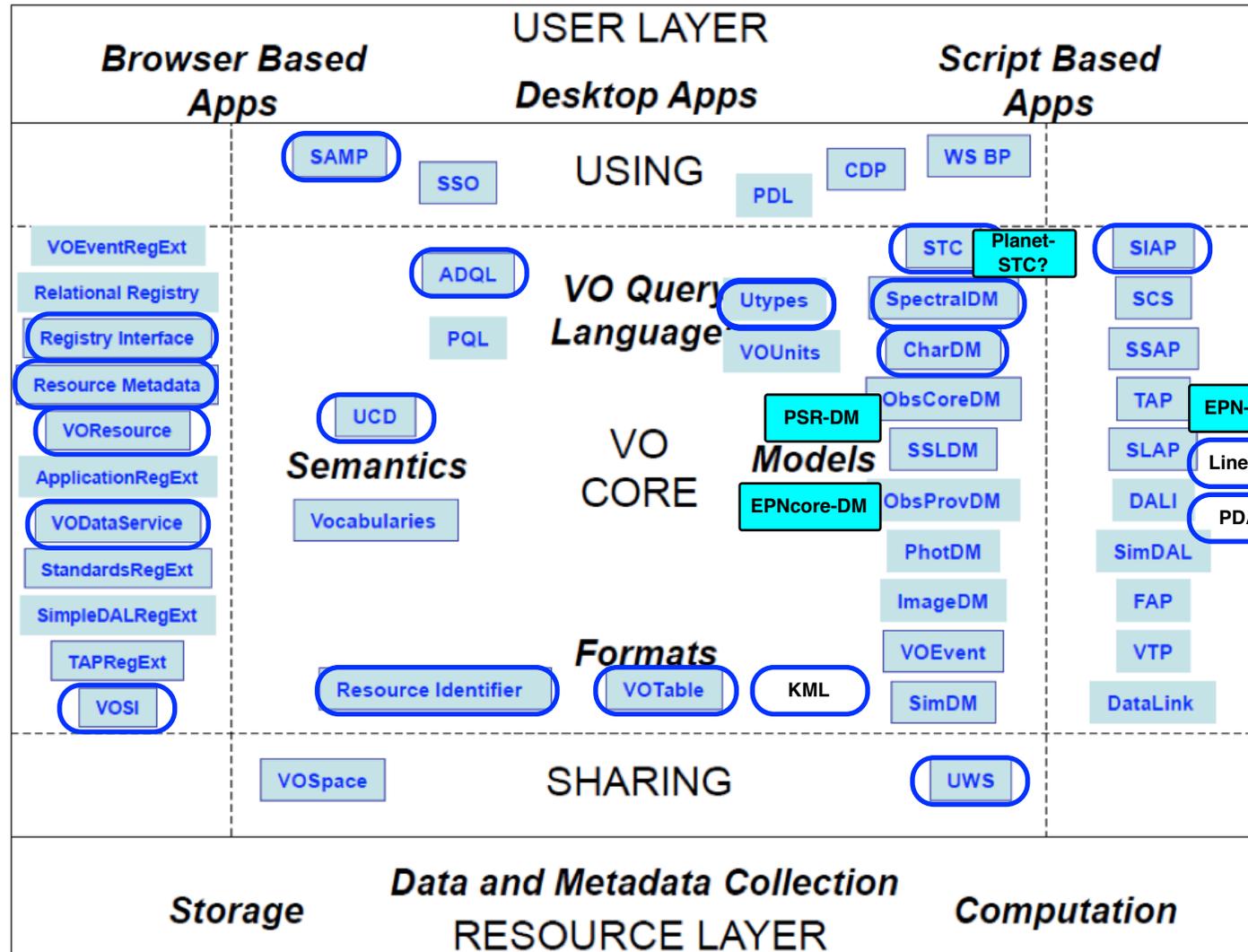
InProgress

EPN specific

Used by EPN

REGISTRY

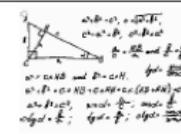
DATA PROTOCOLS ACCESS



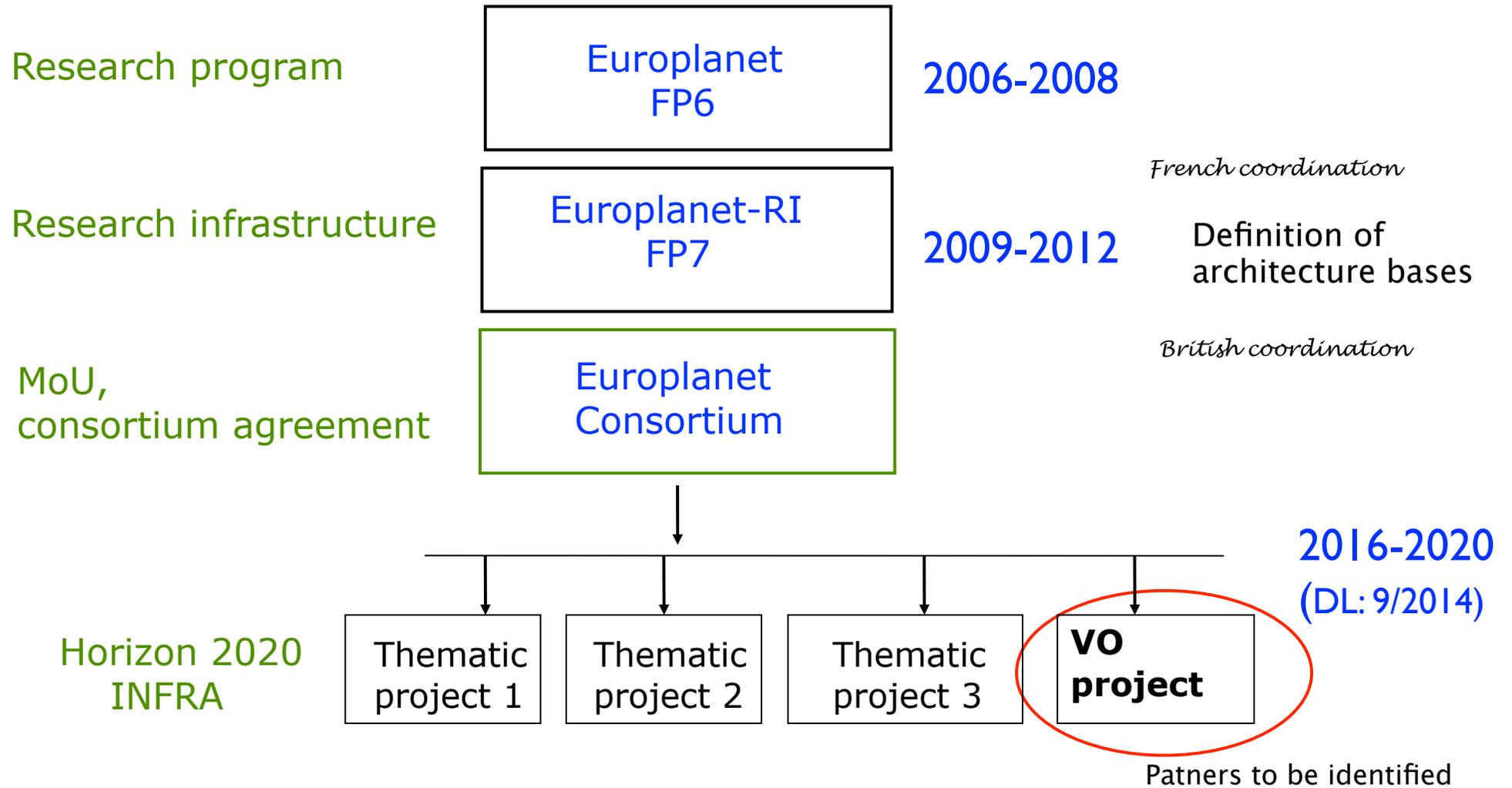
20121120
IVOA Architecture



PROVIDERS



Present context



H2020 project

Builds on EPN-RI / IDIS + other European programs:
IMPEX, HELIO, VAMDC...

Main objectives:

- Provide new science contents online through VO access
- Give visibility to «small teams» which produced original science content
- Improve interfaces with other fields (Astro + Heliophysics + A&M physics, space agency archives...)
- Improve basic tools (access client, visualisation)
- Develop added value tools (processing)
- Have our «standards» widely validated / accepted, and therefore self-sustained

How do we achieve this?

Contents:

Two types of projects:

1) **Integrated projects** with a lead & participants (not necessarily partners in EPN++)

Ex: SSHADE (network of lab spectr. providers)

2) **Small-size contributions projects**, in particular from «small countries». Existing content required, prg will provide technical support to develop VO interfaces, etc...

Data will stay where the expertise is => decentralised system

How do we achieve this?

Tools / Development:

1) Build on tools developed by other communities

Ex: *Mostly IVOA/astro (Aladin, TOPCAT...)*

Possibly OGC/Earth observation (GIS world)

2) Addition of new functions in existing tools, to be done by original developers

Ex: *Aladin => add support for planetary coordinate systems*

3Dview => enlarge data access/mission support

TOPCAT => improve data handling

VOSpec? Alt: Specview, CASSIS

3) Develop data access abilities (EPN client), support new use cases

How do we achieve this?

«standards»: Data Models, access protocols, etc

- 1) Develop EPN-RI JRA4 definition work
- 2) Have standards validated by high level consortia
(IAU, IVOA, IPDA + possibly PDS directly)
- 3) Ask for standard definition lists which do not currently exist
Ex: *List of coordinate systems in planetary science*
=> *study, propose, submit to IAU (or IVOA...)*
- 4) Have these standards used by astronomy tools & standards
Ex: *Merge/include planetary science coordinate systems list*
in IVOA's Space/Time references

How do we achieve this?

Added value tools: Data processing

1) Make specialized developments usable by casual users

Ex: *3Dview + IMPEx infrastructure, to be made accessible*
NEMESIS, ARTT: radiative transfer codes for atm. simulations

2) Develop on-line data workflows (using IVOA engines [Taverna+UWS/PDL])

Ex: *Combine different datasets, extract spectral features...*
Run simulations of observational data, on-line

Overall structure:

Dimensioned as EPN-RI/IDIS (~ 1 M€ ± 20%)

JRA:

Task 1 — Coordination of JRA / enlarge VO contents

Includes support for new small services (topical databases)???

Task 2 — New interoperable community services

Large sub-networks (SSHADE, IMPEX simulation db...)

Task 3 — Tools / added value services

(Aladin, 3Dview, TOPCAT... new capabilities)

Task 4 — Infrastructure and interfaces

(relations with IAU, IVOA, IPDA, PDS...)

SA:

Mostly housekeeping + workshops?

Now looking for new partners – must commit to the above objectives

Prospects

Interested teams can:

- Contribute by setting up "small" data services
 - Requires SQL database + framework (templates available)
 - + a standard view must be implemented
 - + service declared in IVOA registry
- Propose an activity for the Horizon 2020 project
 - To set up big services
 - To work on tools
 - + new activities
- Current call for participations
 - Special session/ round table at EGU 4/2014

