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

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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

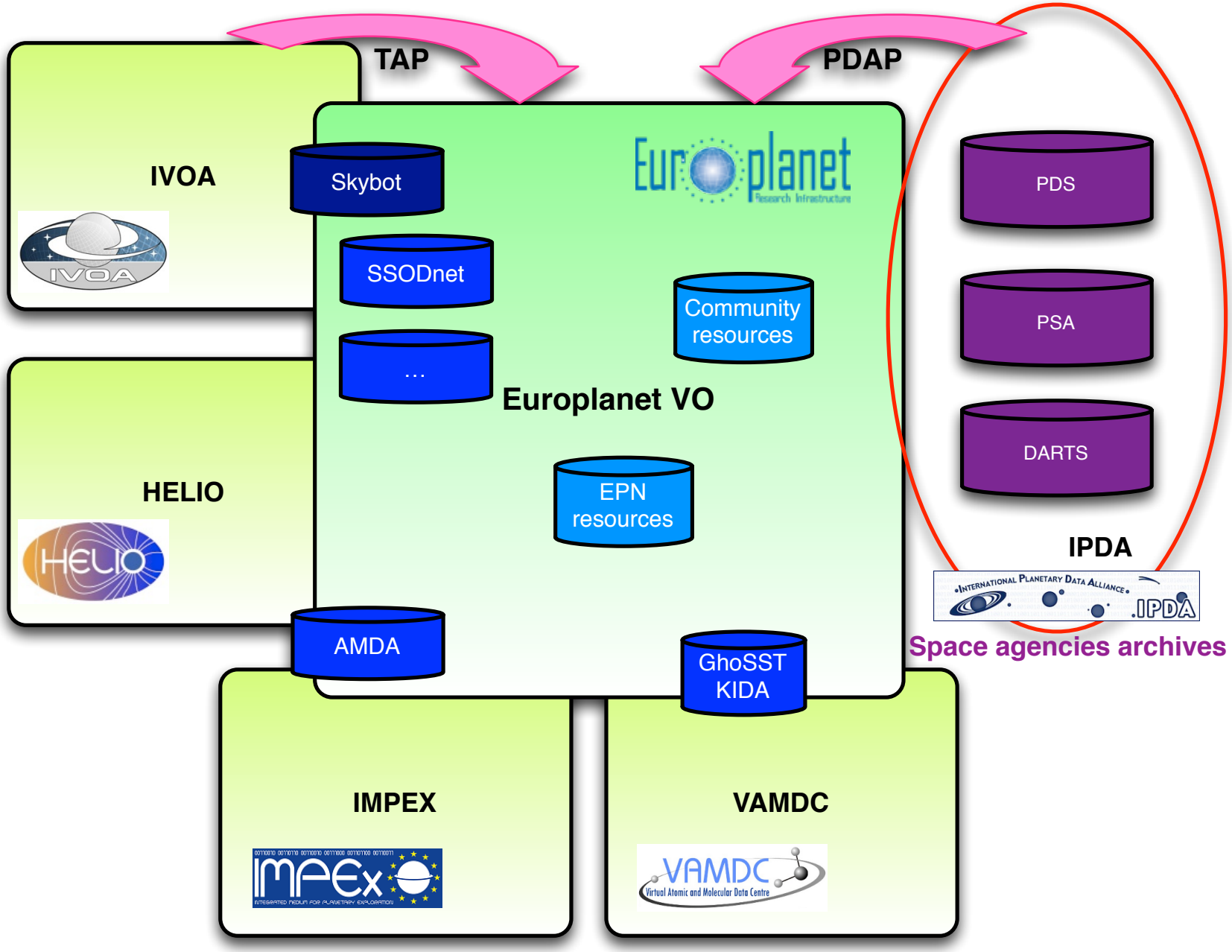
- Make "small" derived data sets accessible
- Develop specific processing/visualisation tools

} Contributions by external users

Constraint: minimise developments

Success: the user doesn't see the infrastructure

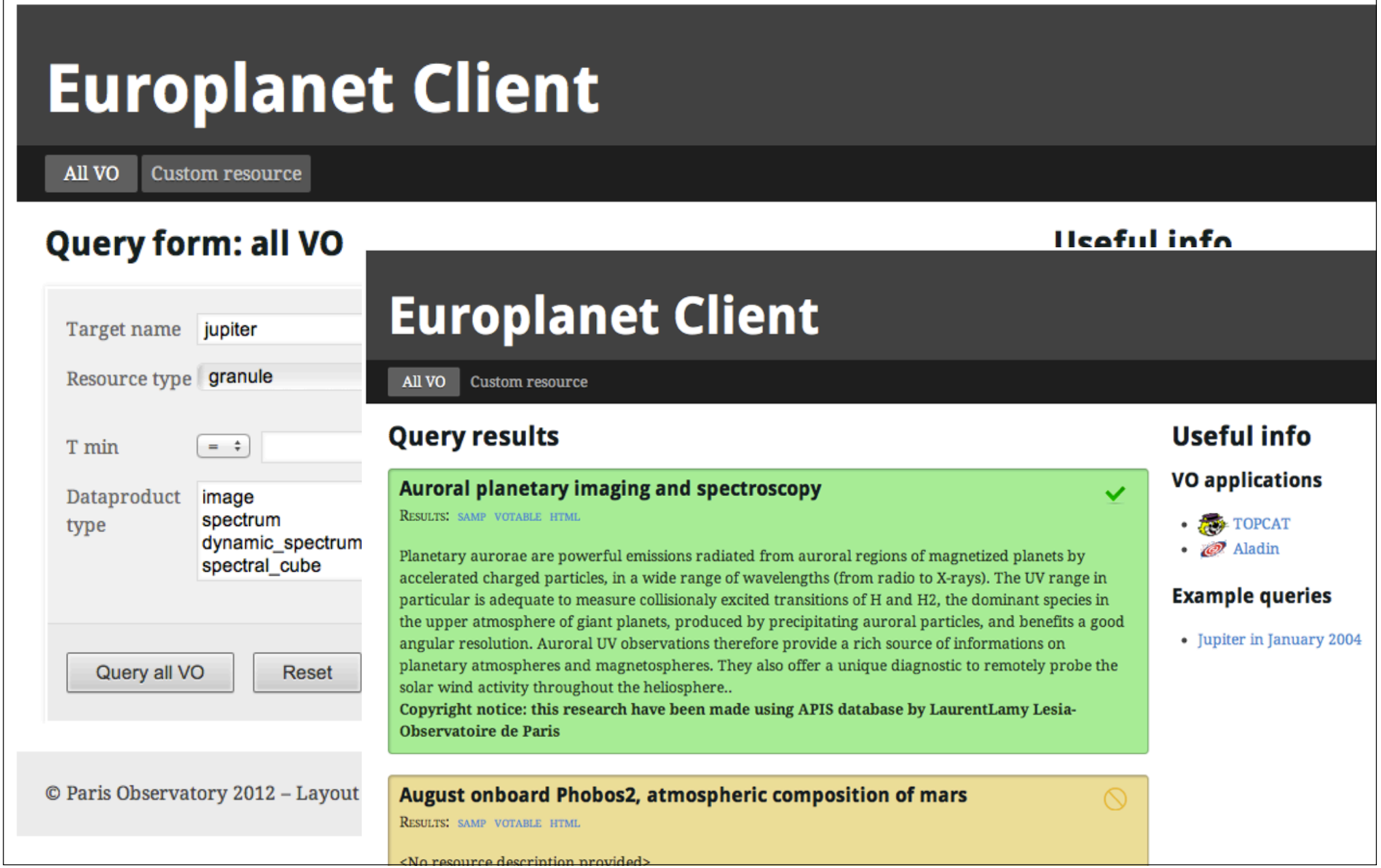
International & thematic context



Client(s) / access

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

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



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)
  - 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/

Google eBay Apple LESIA mail Actualités Stick wiki, etc OVParis

Europlanet Client

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

DARTS

Results : 154

DISPLAY RESULTS DISPLAY VOTABLE SAMP VOTABLE

Waiting for PDAP finalisation

Generated PDAP request:

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

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PSA InterOperability pages (PAIO)

psa.esac.esa.int:8000/aio/doc/

PSA InterOperability pages (PAIO)

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

Planetary Science Archive — European Space Agency

The Planetary Science Archive METADATA Query Service

Search Result (9 Data Sets found)

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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 09:11:01.676666666	2005-01-14 11:00:05.426666666
FTP	XML/Tree	HP-SSA-DISR-2/3-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-6-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-FCO/DESCENT-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 12:10:20.826666666
FTP	XML/Tree	HP-SSA-HK-2/3-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-3/4-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

< < Previous Next > >

Total 9 DataSets

parameter

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

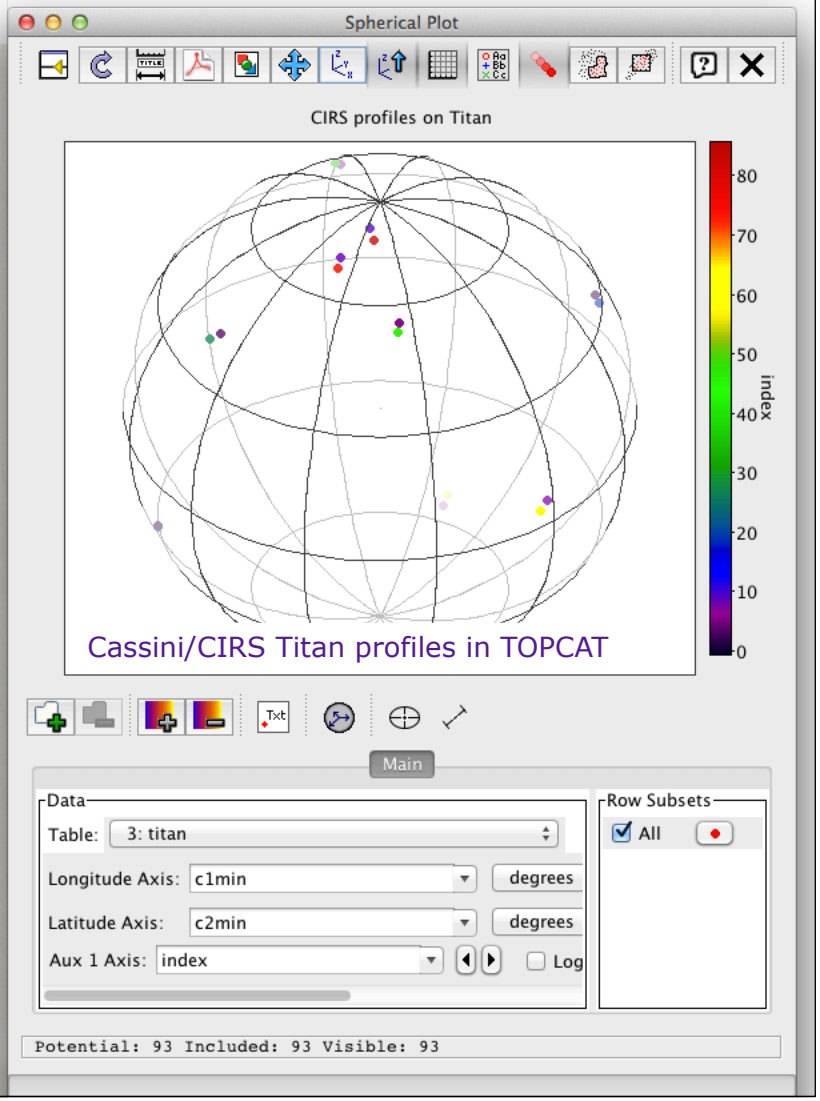
Aladin:

- plots images/cubes
- handles sky/spheroid coordinates

HST / Saturn image from APIS in Aladin

TOPCAT:

- Handles tables
- 2D/3D plots



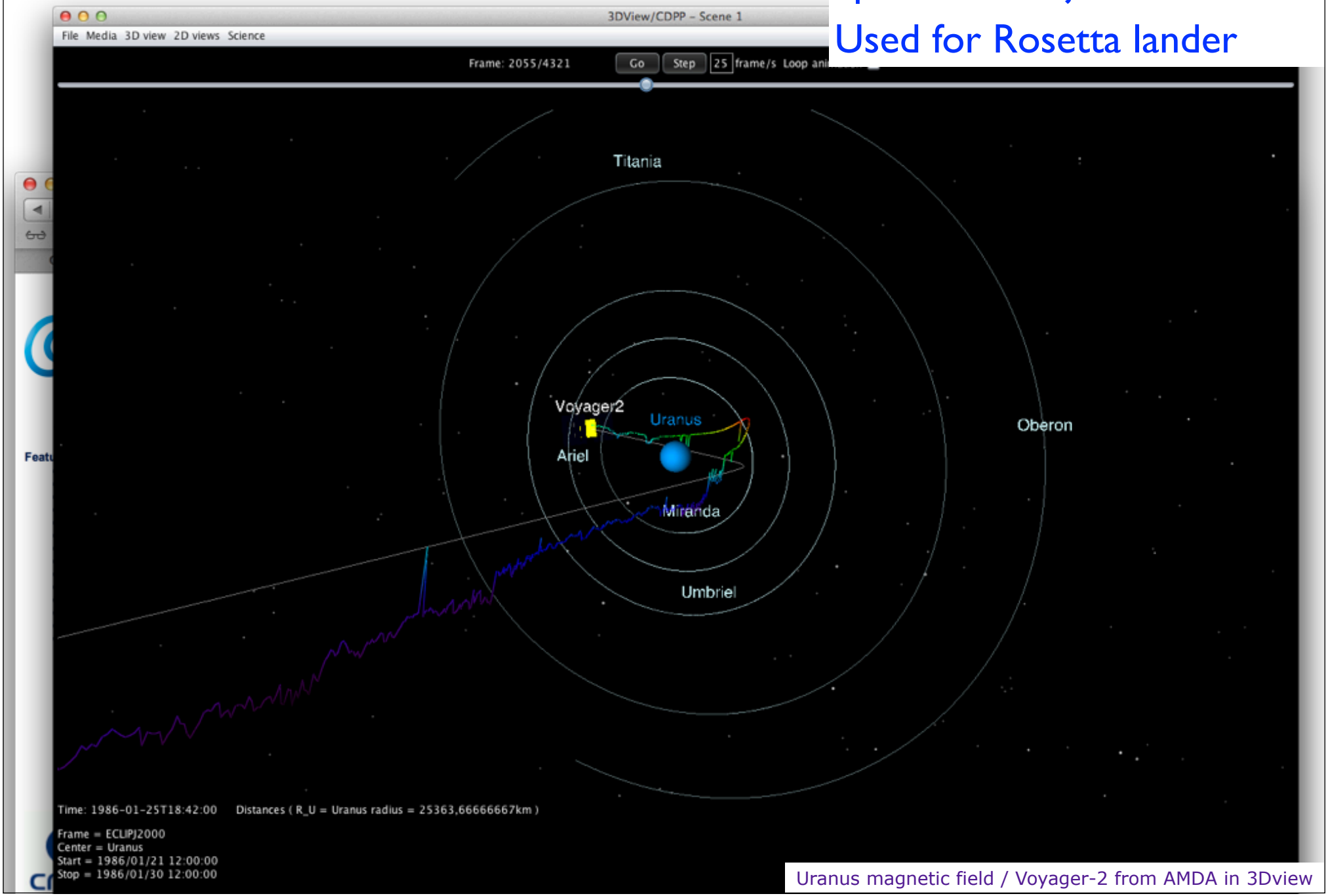
Cassini/CIRS Titan profiles in TOPCAT

Visualization tools: others

3Dview / CNES:

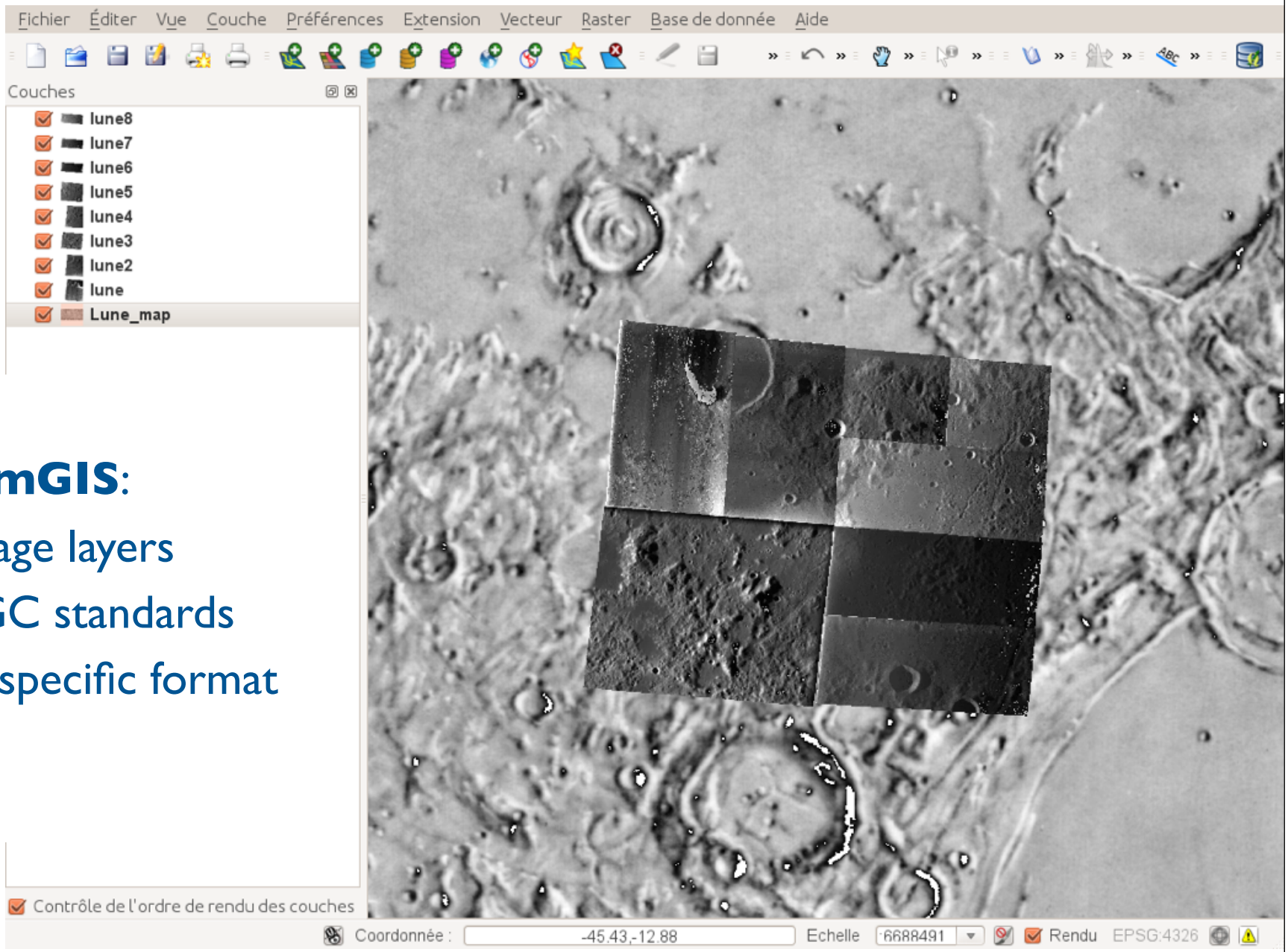
Spacecraft trajectories + data

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

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

Altogether

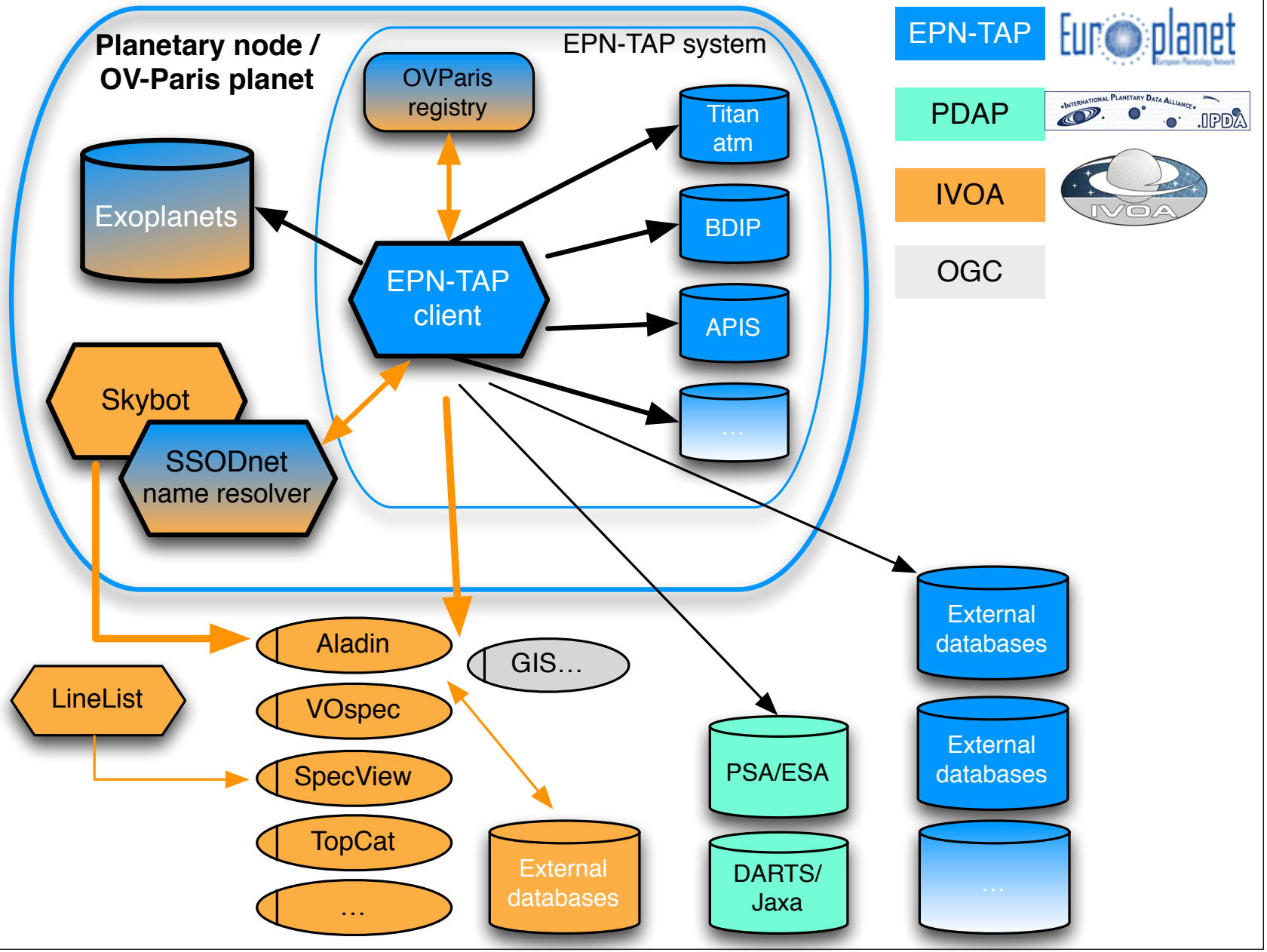
- Very efficient data mining & quick-look system
  - Planetary science supported from Europlanet developments
  - Based on IVOA standards & tools + IAU references
  - Some areas to be optimized in collaboration with IVOA / IPDA / IAU (e.g. description of coordinate systems)

- 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?)

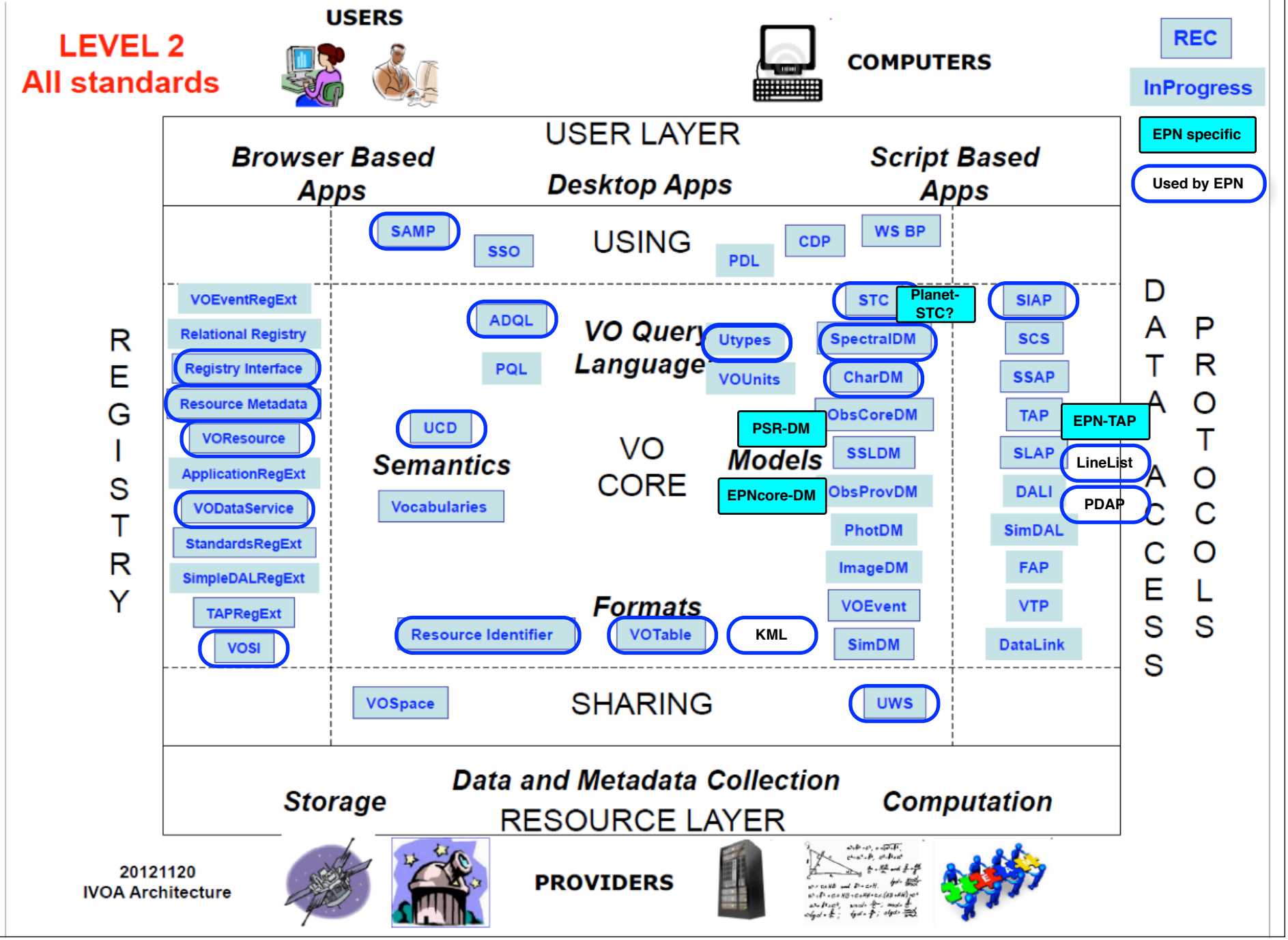
- Currently in basic form => new data services to be implemented

Architecture: VOParis-centric view

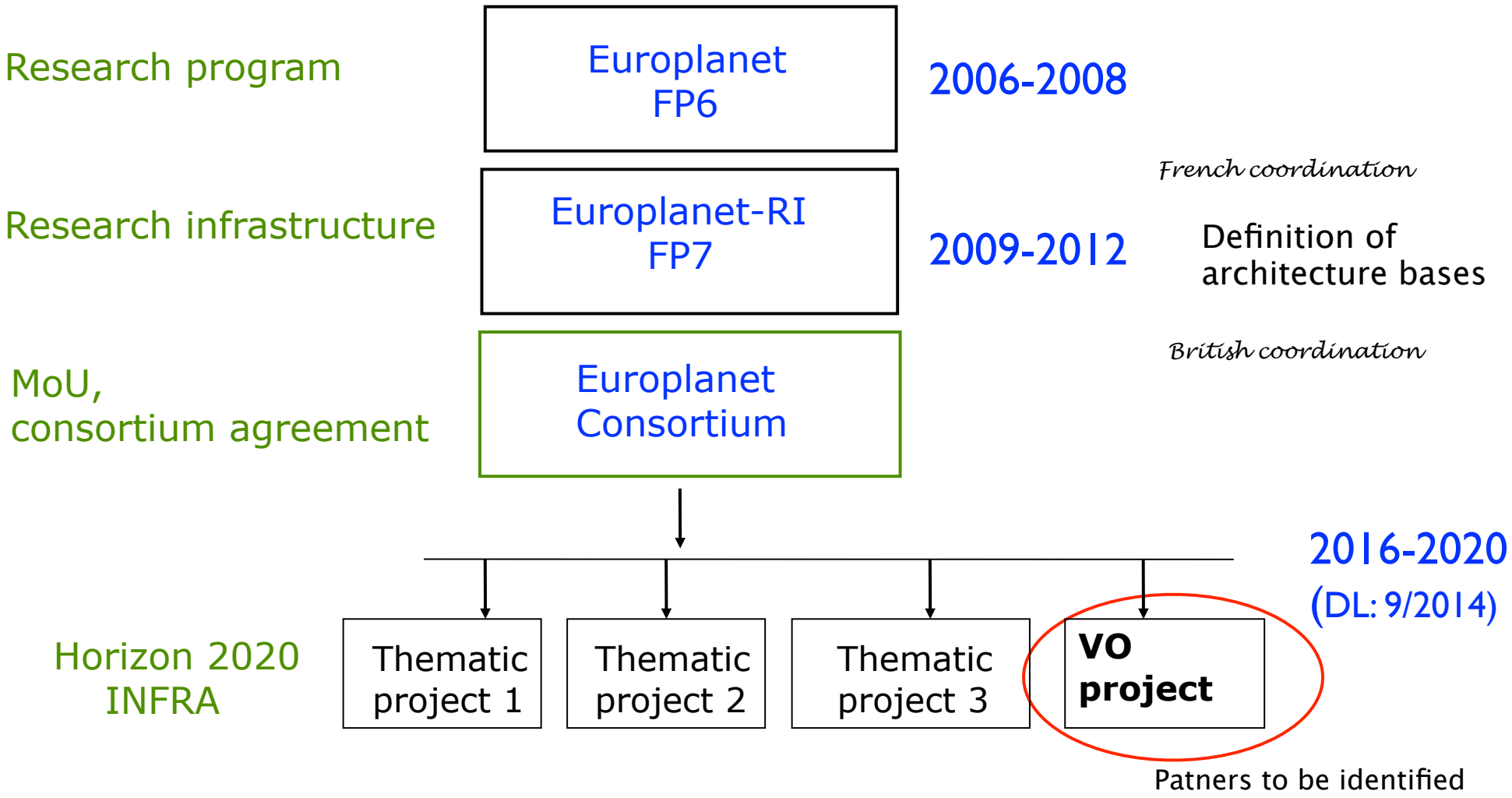
(but it doesn't have to be that way)



IVOA Ioan standards



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 were 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