

Virtual European Solar & Planetary Access (VESPA) 2026: Perseverance

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VESPA history

Bottom-up initiative in European programmes:

Europlanet-RI

(FP7, 2009-2012)

Assessment study

Europlanet 2020 RI

(H2020, 2015-2019)

Basic set-up

Europlanet 2024 RI

(H2020, 2020-2024)

Consolidation, sustainability

Objective:

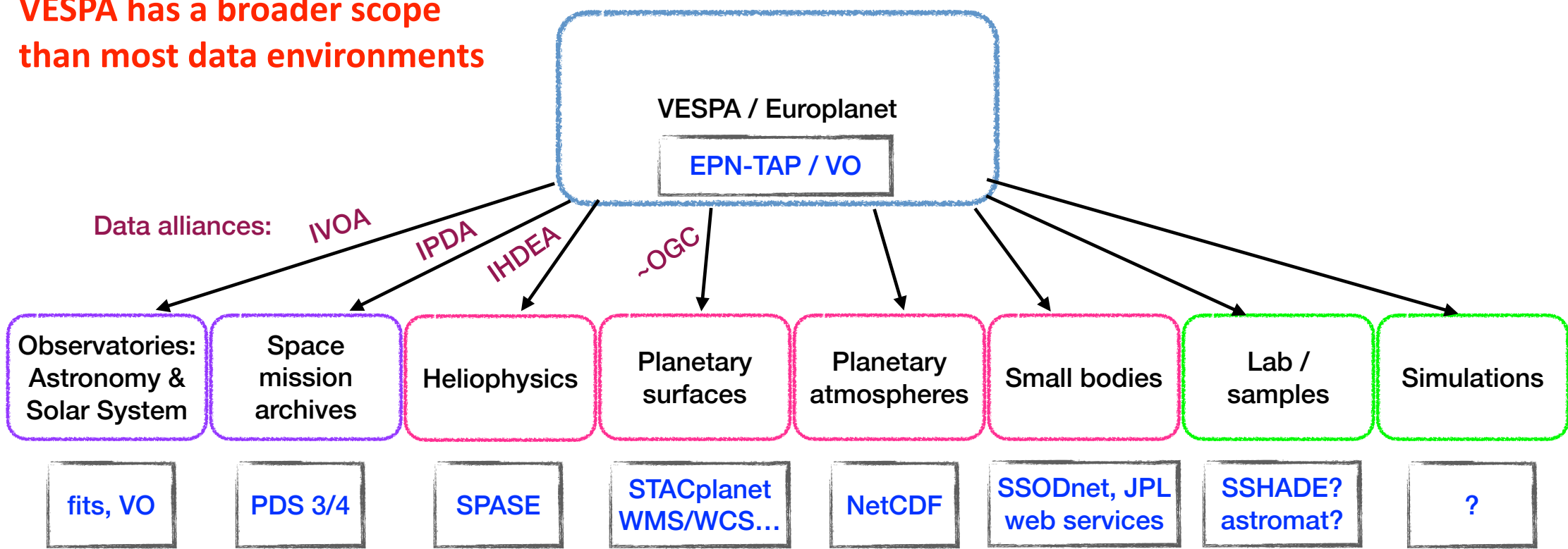
Find data of interest in various environments (space missions, telescopes, lab, simulations)

Architecture:

Virtual Observatory (VO), adapted to Planetary Science

=> Contributive, interoperable, Open Science environment, providing FAIR access to the data

VESPA has a broader scope
than most data environments



Data is heterogeneous and siloed

Interoperability challenges in Planetary Science: Concepts & vocabularies need to be mapped
Formats & access standards need conversion

1- Data description (EPN-TAP)

A data service = a table providing description of each file / data element
the description is uniform => all services respond to the same query

Unified descriptive parameters:
Provenance ; Coverages ; Field-specific ; Access

Results in service apis

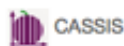
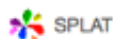
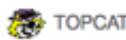
Show 10 entries

Column visibility Show all Hide all

granule_uid	dataprodu	target_name	time_min	time_max	access_url	granule_gid	obs_id	ta
o4bd01ycq_cyl_pdf	image	Saturn	1997-10-11T03:53:03.524	1997-10-11T04:09:43.724	o4bd01ycq_cyl.pdf	cylindric_proj	o4bd01ycq	pli
o4bd01ycq_pol_n_pdf	image	Saturn	1997-10-11T03:53:03.524	1997-10-11T04:09:43.724	o4bd01ycq_pol_n.pdf	polar_proj_north	o4bd01ycq	pli
o4bd01ycq_pol_s_pdf	image	Saturn	1997-10-11T03:53:03.524	1997-10-11T04:09:43.724	o4bd01ycq_pol_s.pdf	polar_proj_south	o4bd01ycq	pli
o4bd01ycq_proc	image	Saturn	1997-10-11T03:53:03.524	1997-10-11T04:09:43.724	o4bd01ycq_proc.fits	processed_data	o4bd01ycq	pli
o4bd01ycq_proc_pdf	image	Saturn	1997-10-11T03:53:03.524	1997-10-11T04:09:43.724	o4bd01ycq_proc.pdf	processed_data	o4bd01ycq	pli
o4bd01ycq_x2d	image	Saturn	1997-10-11T03:53:03.524	1997-10-11T04:09:43.724	o4bd01ycq_x2d.fits	original_data	o4bd01ycq	pli
o4bd01yeq_cyl_pdf	image	Saturn	1997-10-11T04:15:43.524	1997-10-11T04:28:37.134	o4bd01yeq_cyl.pdf	cylindric_proj	o4bd01yeq	pli
o4bd01yeq_pol_n_pdf	image	Saturn	1997-10-11T04:15:43.524	1997-10-11T04:28:37.134	o4bd01yeq_pol_n.pdf	polar_proj_north	o4bd01yeq	pli
o4bd01yeq_pol_s_pdf	image	Saturn	1997-10-11T04:15:43.524	1997-10-11T04:28:37.134	o4bd01yeq_pol_s.pdf	polar_proj_south	o4bd01yeq	pli
o4bd01yeq_proc	image	Saturn	1997-10-11T04:15:43.524	1997-10-11T04:28:37.134	o4bd01yeq_proc.fits	processed_data	o4bd01yeq	pli

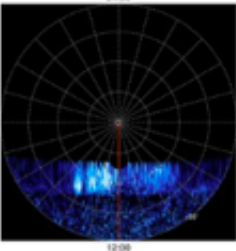
Showing 1 to 10 of 15,506 entries

Plotting tools



Example queries

Saturn in March 2012



2- Accessing data

Main portal

(interactive discovery)

<https://vespa.obspm.fr>

Geoportal

(georeferenced data)

<https://padc-findme.obspm.fr>

A Mercury volcanic unit in VESPA geoportal
+intersecting spectral footprints

VO tools

(TOPCAT, Aladin

web clients, etc)

EPN-TAP query protocol

Locate individual data products meeting certain conditions (observational or instrumental)

Typical request for surfaces:

Mars, a given region (Tharsis volcanoes area) — images, spectra or spectral-cubes

Illumination conditions ($i \leq 20^\circ$, phase $\leq 50^\circ$)

Local time or season range (L_s)

Minimum resolution

Spectral range / filter

etc

The portal displays a simple parameter form to build the query

Returns results from each service
=> need to be described at similar level

The VESPA portal is a simplified, single-entry point to validated data services:

<https://vespa.obspm.fr>

The screenshot shows the VESPA (Virtual European Solar and Planetary Access) portal. The header includes the VESPA logo and the text "Virtual European Solar and Planetary Access". Below the header, there is a "Refine your search" section with a "Main Parameters" form. The form includes fields for "Target Name", "Target Class", "Dataproduct Type", "Instrument Host Name", "Instrument Name", and "Processing level". There are also dropdown menus for "Time", "Location", "Spectral", "Illumination", "Data Reference", and "Optional". A red bracket labeled "TAP query" points to the "Spectral", "Illumination", and "Data Reference" fields. To the right of the form, there is a "Data Services" section listing various data services with their result counts. Below this, there is a "Generated WHERE clause of ADQL statement:" section showing a complex SQL query. At the bottom, there is a "Reset" button and a "Submit" button. A purple arrow points from the text "All results in a single table" to the "Submit" button.

Refine your search

ADQL Query

Data Services

abs_cs - Data for numerical modeling of planetary atmospheres 13 results

APIS - Auroral Planetary Imaging and Spectroscopy 74175 results

BaseCom - The Nançay Cometary Database 6886 results

bass2000 - Bass2000 solar survey archive 357033 results

BDIP - IAU database of historical planetary images 16906 results

cassini_jupiter - Cassini RPWS/HFR Calibrated Jupiter Flyby Dataset 7 results

CLIMSO - CLIMSO coronagraphs at Pic du Midi de Bigorre 1021345 results

cpstasm - CLUSTER STAFF-SA Spectral Matrix Data 11688 results

DynAstVO - Asteroid orbital database and ephemerides 29733 results

eit_syn - Synchronous synoptic maps of the solar corona from EIT/SoHO 18482 results

ExoPlanet - Extrasolar Planets Encyclopaedia 5177 results

ndcs - NASA cosmic dust catalogues

Generated WHERE clause of ADQL statement:

```
SELECT * FROM ... WHERE ((c1min <= c1max AND c1min <= 265.0 AND c1max >= 235.0) OR (c1min > c1max AND (c1min <= 265.0 OR c1max >= 235.0))) AND c2max >= -15.0 AND c2min <= 15.0 AND (1 = ivo_hashlist_has(lower("target_name"), lower('Mars')) OR 1 = ivo_hashlist_has(lower("target_name"), lower('4')) OR 1 = ivo_hashlist_has(lower("target_name"), lower('499')) AND "incidence_min" <= 20.0 AND "spatial_frame_type" = 'body')
```

EPN-TAP compilation results

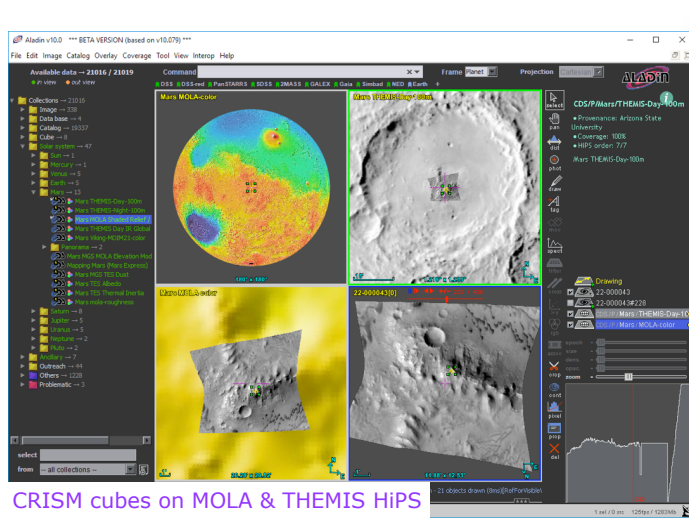
Reset Submit

All results in a single table

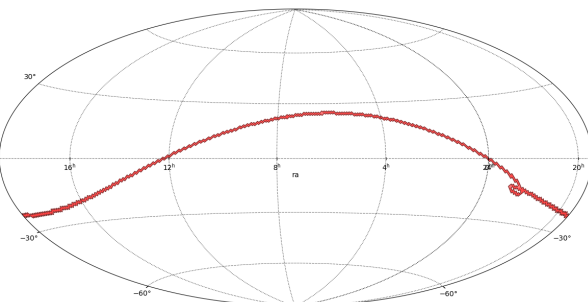
3- Visualization and analysis through VO tools

Use cases — see Erard S. et al EPSC 2025, Helsinki

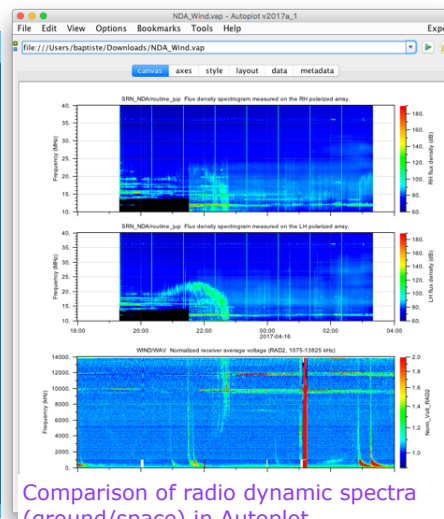
https://github.com/ePN-vespa/tutorials/blob/master/misc/use_cases_2025/VESPA_EPSC_2025.key.pdf



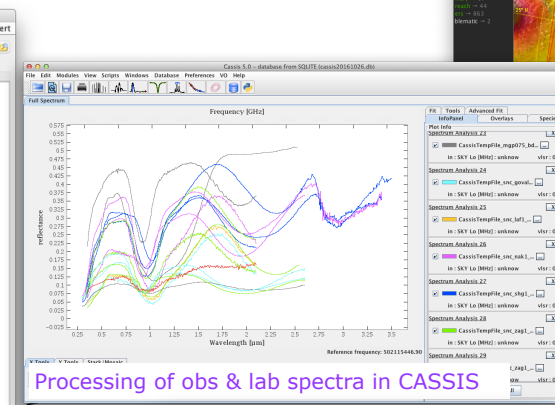
CRISM cubes on MOLA & THEMIS HiPS



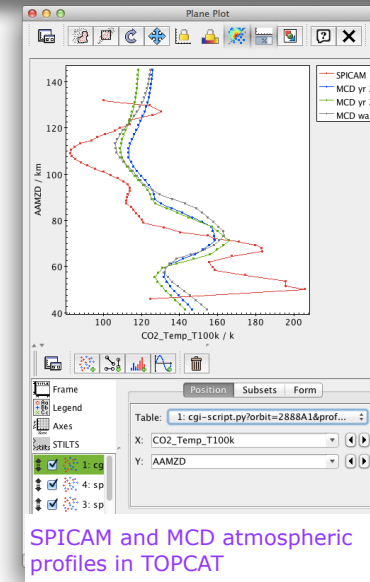
Mars 2002-2003 trajectory as ST-MOC



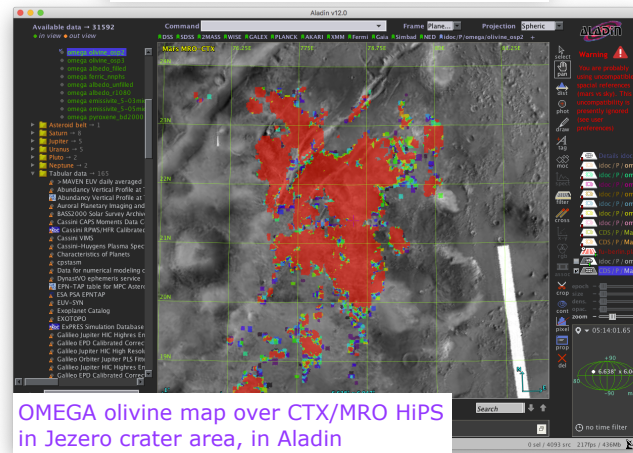
Comparison of radio dynamic spectra (ground/space) in Autoplot



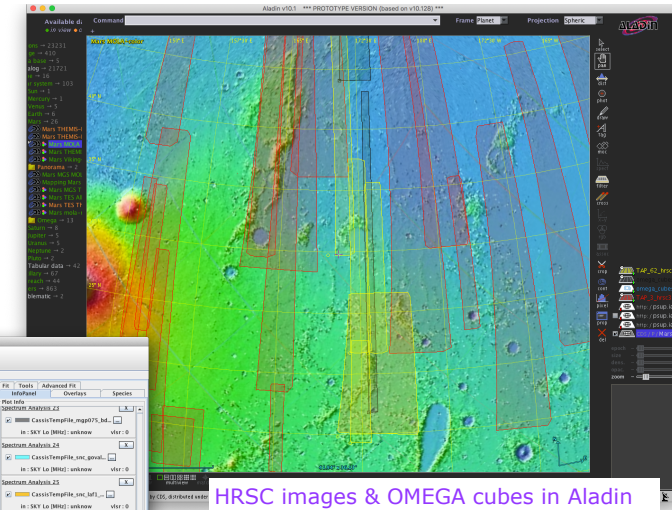
Processing of obs & lab spectra in CASSIS



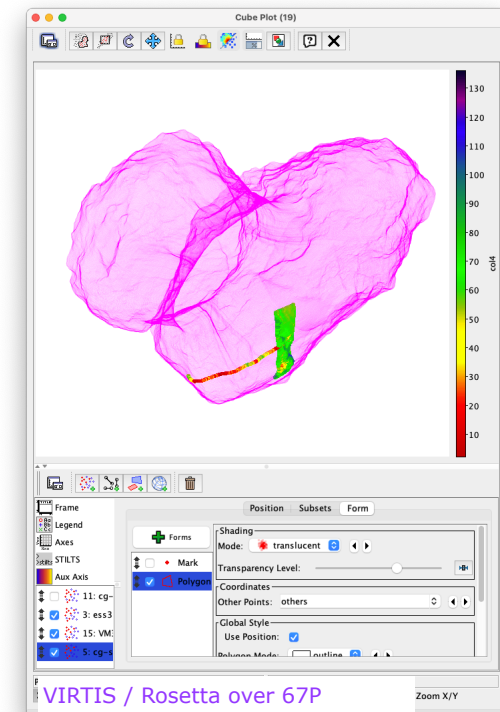
SPICAM and MCD atmospheric profiles in TOPCAT



OMEGA olivine map over CTX/MRO HiPS
in Jezero crater area, in Aladin



HRSC images & OMEGA cubes in Aladin

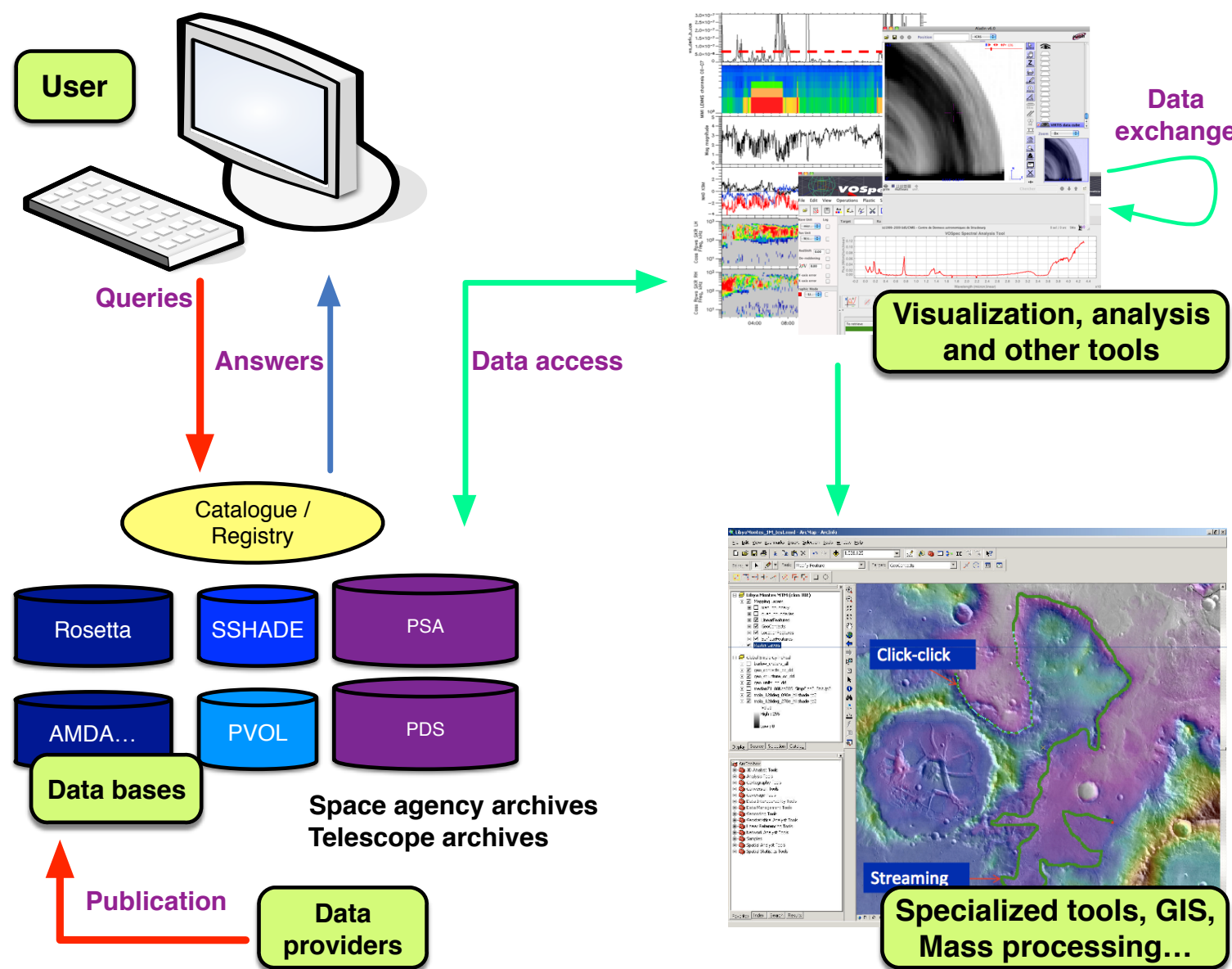


F VIRTIS / Rosetta over 67P

4- Data services

Provided by the community
No data center, just connections

Research teams, institutes
EU projects, etc



VESPA novelties since Europlanet 2024 RI

New validated data services:

- **Gaia DR3 asteroid spectra** (60 00 spectra)
- **TNO spectra from VLT large programme**, 2017
- **Recalibrated VIRTIS/Rosetta archive** (imaging channel) & **refined archive** with shape coordinates (both channels)
- **In progress**: Swedish Solar Telescope spectro/polar/imaging, RELAB archive, stellar occultations, comet observations by amateurs @ ObsParis, small body & planetary images @ CNES, NEOROCKS @ ASI, PDS PPI collections @ UCLA, etc
- **New planetary HiPS** (multi-resolution maps converted from USGS and more)

New fields supported by EPN-TAP:

- Stellar occultations; Spectro-polarimetry; Mass spectroscopy; Lunar flashes; etc

New use cases => tool functionalities:

- Finding planetary data in observatory archives (ESO, CADC, ESA, etc)
- Plotting data on 3D shape models
- Cross-matches: small bodies services; observational and lab spectra; integrating spectra in geological units, etc

Why do you want to use VESPA?

Science user side

- Environment to find data not available elsewhere

Derived data from publications

Outcome of public-funded programmes

- Allows filtering on observational / instrumental condition

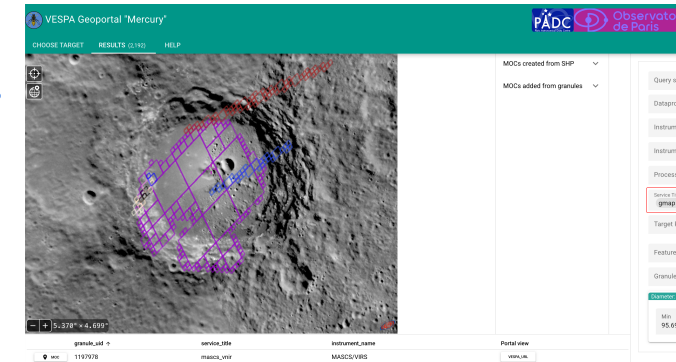
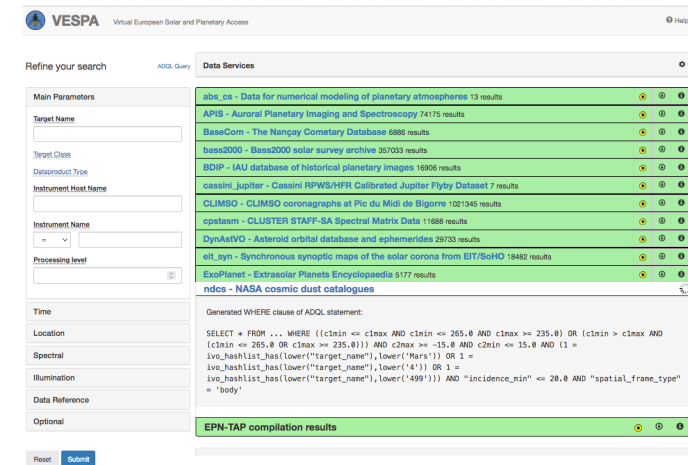
Based on physical parameters, configurations, etc

- Allows visualization of data products

Using Virtual Observatory tools - tables, spectra, images, times series...

- Allows cross-matching of various datasets

on above parameters or footprints



Data publisher side

- Share data from a publication
So you don't have to answer mails
~ 50 abstracts mentioning new databases at EPSC 2026
- Simple and economical way to make programme results available
You've committed to this and realize you have no idea how
- Not an exclusive system
Just an additional user interface
- Updates as desired
You keep full control of your data

If you're running an experiment

— in a private context

- Simple and flexible way to setup a private database for an experiment or small observatory
Maintain data catalogues in a clean way, keep track of everything
The same VO tools are available for visu and analysis
You can cross-match with public archives
Will be ready for partial publication if required
- Robust environment to develop ground segment of a space experiment
Will handle data but also ancillary files & housekeeping parameters
Shared web access with password or token (in progress)
Will help prepare the archive to be delivered to the agency
- Publish late recalibrated datasets
while no update is possible in the agency archive

If you're a early carrier scientist

- You want to organize your work to save time

- Maintain catalogues of data of interest

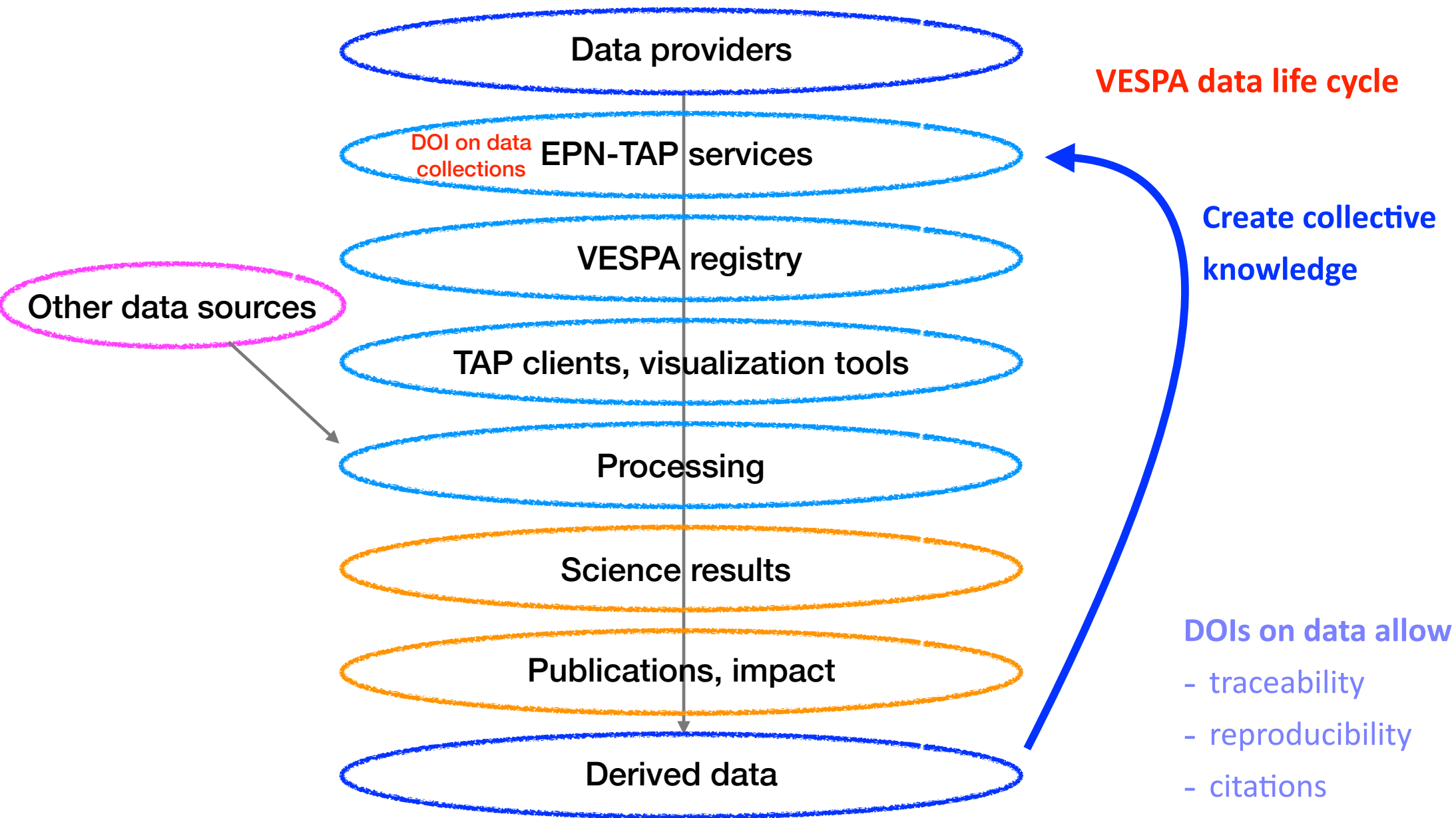
Easy cross-match with public archives

Keep track of every data product + interface with SciX / ADS

- Use VO tools! They are available for visu and analysis (TOPCAT, Aladin, CASSIS...)

Open Source tools can be connected to the VO

Programmatic access (e.g., multi-language Jupyter notebooks)



Main portal: <https://vespa.obspm.fr/>

Geoportal: <https://padc-findme.obspm.fr>

Tutorials and use cases: <https://github.com/ept-vespa/tutorials>

Web site: <http://www.europlanet-vespa.eu/>