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PSA 2020: TOWARD THE DISCOVERY OF ESA PLANETARY DATA THROUGH 2D AND 3D INTERFACES

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Introduction: During 2020, when the world was shut down due to the pandemic, the Planetary Science Archive (PSA) [1] [3] Team has worked hard to release two brand new interfaces for the Planetary Science Archive, combining better user experience through 2D/3D interactive interfaces with stronger scientific exploitation thanks to the computation of key instrument and geometrical parameters from the relevant ESA planetary data. The release finally happened on Dec 16th.

We present here the main use cases and the architecture of both the 3D Interface for Comet 67-P/Churyumov-Gerasimenko and the 2D Map View for Mars.

67-P/Churyumov-Gerasimenko 3D Interface: The Rosetta 3D Shape Model interface developed for the PSA has been designed with the user experience in mind. Considering the irregular shape that has been observed by Rosetta, 3D visualization is considered a more natural way to discover and retrieve all 67-P/Churyumov-Gerasimenko observations from the relevant instruments (NAVCAM, OSIRIS, VIRTIS, ALICE and MIRO). The new interface also adds scientific value by combining a visual 3D experience with a new set of instrument/geometrical key data.

The user interface (Figure 1) has been developed in Java, using the Vaadin framework. Three.js libraries have been embedded into Vaadin for a superlative graphical experience.

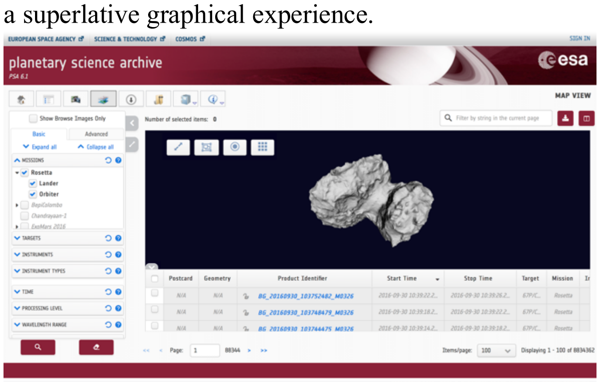

Figure 1: Shape model of comet 67-P/Churyumov-Gerasimenko shown in the new 3D Interface for the Rosetta mission.

In the initial view upon opening the interface, the user is presented with the interactive 3D shape model of the comet. The user can zoom and rotate the model, and select any region of interest on the shape model itself to retrieve the associated observations. At the same time, the algorithm retrieves all products from the different instruments from the database, that match the selected region of interest plus the instrument/geometrical parameters selected in the filter menu. All the products matching the selection are provided to the user in the table view shown in Figure 2. In the second scenario, the user can select any product of interest from the table view and this will be drawn as a set of facets (small triangles) on the shape model itself, revealing its location and extent of the observation (Figure 2).

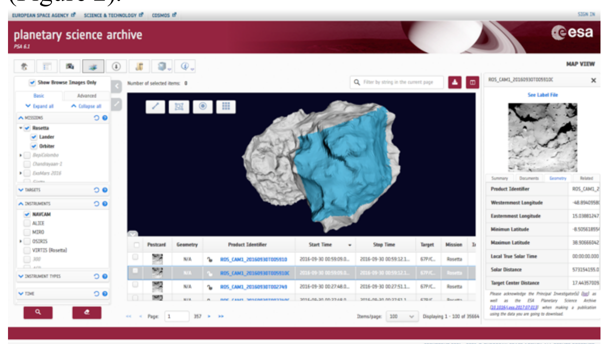

Figure 2: Navcam observation of 67-P/Churyumov-Gerasimenko, big portion of small lobe.

We were able to achieve low latency for both use cases, thanks to the fact that the association between facets and products is pre-calculated, using as input the key observing parameters and characteristics of each instrument.

Precomputation is done through a command-line script that is executed on all the observations of the Rosetta instruments. This executable considers the FOV of each instrument to calculate the facets of the shape model belonging to each product.

This information is stored in the database for faster retrieval before projecting the field of view of one product to the 3D shape model.

2D Map Interface for Mars: The new PSA supports Geographical Information Systems (GIS) by implementing the standards approved by the Open Geospatial Consortium (OGC). Integrating GIS in the PSA facilitates the users in handling and visualising the many products stored in the archive which have spatial data associated.

To guarantee homogeneity and to allow direct comparison between all instruments from different missions that have observed Mars, ESA has developed GEOGEN [2], a SPICE based command line interface to compute the observation geometry parameters and footprint associated to PDS observational data products. This development was done in collaboration with SpaceFrog Design.

The result is a 2D Mars Map Interface where users can access, query and discover Martian observations through the many instrument/geometrical parameters available and through the interactive 2D Map View (Figure 3).

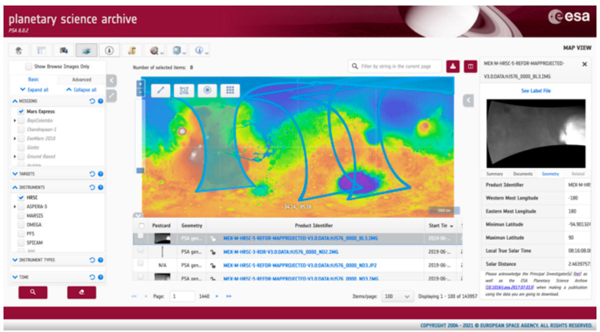

Figure 3: Mars observation from MEX HRSC instrument.

GEOGEN gets as input specific products metadata, the type of instrument (frame, line, point detector) and relevant SPICE kernels to compute multiple geometrical parameter for each product. Footprints are generated and stored in the DB as standard OGC Simple Feature Geometry objects. All this information is ingested in the PSA postgresSQL/PostGIS database for easy access. PostGIS is a spatial database extender for PostgresSQL object-relational database. It adds support for geographic objects allowing location queries to be run in SQL.

Geoserver is the PSA open source server of choice for sharing geospatial data. All the relevant metadata are exposed to the Java based user interface through Geoserver, and eventually other tools like QGIS for the benefit of the scientific community that could use WFS/WMS calls to get the information.

The overall architecture has been designed with scalability in mind, in order to be able to extend the use cases and use the same workflow for other planets and small bodies of the Solar System that will be observed by ESA planetary missions.

References

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