Advanced Search in the PSA for ExoMars TGO Data Discovery

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Introduction: The ExoMars (Exobiology on Mars) program is a joint venture between the European Space Agency (ESA) and Roscosmos, with a contribution from NASA. The program is split into two missions: ExoMars 2016 and the Rover and Surface Platform (RSP). ExoMars 2016 was launched in March 2016 and comprises an orbiter and a lander. Its primary component is the Trace Gas Orbiter (TGO), which is aimed at studying trace gasses in the Martian atmosphere and geological features on the surface, as well as acting as a relay spacecraft for landed assets. The Schiaparelli lander was mainly aimed at demonstrating landing technology but was also carrying a small science payload. After arrival at Mars in October 2016, TGO and Schiaparelli separated and a landing attempt was made. Successful demonstrations of many technologies resulted but the landing failed at the final stages due to a sensor error. Since April 2018 TGO has been operating nominally with both science and relay operations ongoing.

The RSP mission is due to be launched in 2022 with Mars arrival and landing in Oxia Planum in 2023. This will carry full scientific payloads on both the landing platform and a rover. The mission will investigate the Mars surface and sub-surface context for biological signatures over a period of six months.

ExoMars 2016 data products are downloaded daily from the spacecraft and hosted in the Planetary Science Archive (PSA). Given that the PSA is the only repository facility for all ESA's Solar System missions, efficient searching capabilities through products and metadata are essential in order to maximize scientific return.

The PSA UI and the ExoMars Panel: The PSA user interface offers multiple search capabilities, starting with the simplest ones (Figure 1). Users can sift through the archive's content filtering in the 'Basic' search panel by criteria such as mission, instrument, target and wavelength range, and can visualize their selected output in one of the archive views currently available (Table, Image or Map views).

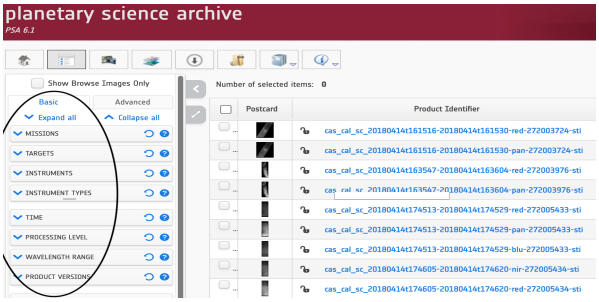

Figure 1. The main PSA interface, Table View mode, 'Basic" search panel

In addition to the 'Basic' search, an 'Advanced' search panel is also being developed. This panel is used for a highly customized search based on instrument specific metadata present in products labels. Given the multi-mission nature of the PSA, this will become an essential tool for very focused selections. The first instrument to be deployed for ExoMars TGO in the 'Advanced' panel is the Colour and Stereo Surface Imaging System (CaSSIS). The specific metadata for the wavelengths used by the camera's filters are provided in the PDS4 product labels and ingested in the PSA database. The users can then select CaSSIS data products based on one or more of the filter wavelengths available in the 'Advanced' search panel (Figure 2).

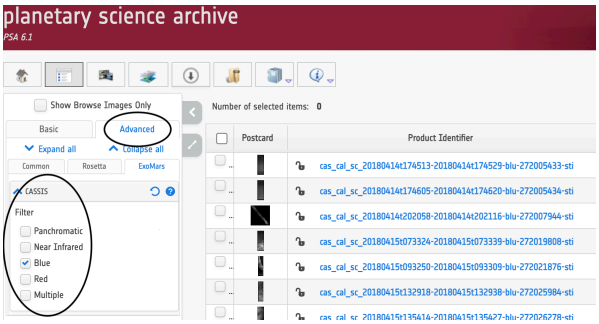

Figure 2. 'Advanced' search panel for the Cassis instrument

Using CQL to Refine Searches: It is also possible to refine a search using Common Query Language (CQL) commands on label metadata. CQL is integrated in the PSA user interface and can be used in combination with other types of searches in both the 'Basic' and 'Advanced' panels.

Figure 3 gives an example for a CaSSIS use case where an archive user only wants stitched images. The CQL search is done on a particular component of the product's logical identifier:

logical_identifier like '%sti%'

More examples of CQL searches are given in the quick start guides provided for the TGO instruments.

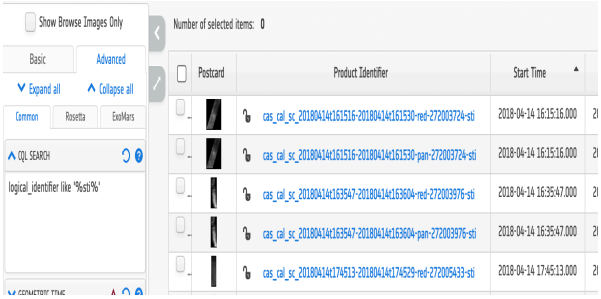

Figure 3. CQL search for a CaSSIS stereo image

Future Plans: ExoMars TGO is a young mission with more and more observations populating the archive every day. Further development of the PSA search features is equally advancing, with many concurrent ideas being investigated and implemented. For example, one such idea is the capability of computing observations geometry on-the-fly consistently for all archived missions, therefore making it possible to perform cross-mission searches quickly and efficiently.

The 'Advanced' search panel will be extended to other instruments and metadata for TGO and the ExoMars RSP payload. For example, for the spectrometer Atmospheric Chemistry Suite (ACS) on TGO it will be possible to search for observation mode or for the many instrument specific geometry quantities present in the product label.

For PDS4 products it will also be eventually possible to find and retrieve all products that are referenced in the PDS label of a single product via the Internal Reference class, e.g. raw products for higher level products, in one swift click of the mouse.

In this poster we will detail the search interfaces developed so far and the proposed enhancements in future.