ExoMars TGO Data in the PSA: The First Four Years

T. L. Lim[1], D. Coia[1], M. Bentley[2], J. Osinde[3], E. Grotheer[4], D. Heather[2], A. Villacorta[1].

[1]Telespazio UK Ltd for ESA (Camino Bajo del Castillo s/n, 28692 Villanueva de la Cañada, Madrid, Spain)
[2]ESA/ESAC (Camino Bajo del Castillo s/n, 28692 Villanueva de la Cañada, Madrid, Spain)
[3]Rhea for ESA (Camino Bajo del Castillo s/n, 28692 Villanueva de la Cañada, Madrid, Spain)
[4]SERCO for ESA (Camino Bajo del Castillo s/n, 28692 Villanueva de la Cañada, Madrid, Spain)

Introduction: The ExoMars Trace Gas Orbiter (TGO) mission has the dual purpose of the scientific investigation of the Martian atmosphere and as a European/Russian provided relay for missions on the surface. ESA's Planetary Science Archive (PSA) is the long-term home for all scientific data returned from ESA Solar System missions including the TGO and it is the main repository for this data serving the community, with a copy of the data also available in the Russian ExoMars archive.

ExoMars Data: The TGO has four instruments, an epithermal neutron spectrometer (FREND), a four-colour push frame imager (CaSSIS), and two complementary high-resolution spectrometers (ACS and NOMAD) which have both nadir and occultation modes. FREND operates continuously during the 12 orbits a day at 400 Km, and the other three instruments operate during scheduled observations. FREND data is currently archived as a set of 24-hour timelines (previous data versions used 6 hours). ACS (NIR and MIR channels) and NOMAD typically produce one science product at each processing level per observation. ACS TIR produces many interferogram products per observation. CaSSIS raw and calibrated data consist of separate products per filter per framelet, so a three-colour observation of 40 framelets would yield 120 raw and 120 calibrated products plus the same number of browse products. CaSSIS also has stitched products at calibrated level. These products are not radiometrically calibrated but instead are essentially browse images for the observation. CaSSIS can operate in stereo mode where the instrument telescope mechanism is rotated to repeat the observation in reverse from a different part of the orbit. No specific stereo products are archived yet however so an archive user will need to download the two observations separately.

Data in the PSA: The PSA offers a variety of ways to search for planetary data, the user interface provides views via a table, an image gallery and a map interface. Currently TGO data is available though the table view and image gallery. A project to make CaSSIS data available via the map view is nearing completion and this will be available in spring 2022. The projection of ACS and NOMAD tracks on the map view is under study and may be phased with the nadir tracks being added first.
The TGO data are also available via a simple file system browser, FTP access and the two APIs (PDAP and EPN-TAP).

Release Status: Two of the instruments, CaSSIS and NOMAD have publicly available data, with the raw data being made available on a six-month rolling release. Calibrated data is also made available on this six-month timescale, but it is dependent on deliveries from the instrument teams so may lag behind at times. An exception currently exists for the NOMAD LNO channel data which are still undergoing initial calibration; however, this is expected to be made public in spring/summer 2022. A review of the FREND dosimeter channel is currently concluding so these data should also become public in the same timeframe. A review for the ACS instrument is currently being prepared and the dates for the review the FREND Neutron channel are still TBD.

Data Versions: All RAW level data processing (DP) takes place in ESAC, and the PSA is populated with new products on a daily basis. Major product versions are incremented with a major update of the DP software and are currently at version 3.0. Hence this will be the first version for current observations. All products have been bulk reprocessed to version 3.0. Version 2 exists for all products up to April 2021 and in some cases version 1 has been deleted following recommendations from reviews. Note older product versions are not displayed by default in the PSA but can be accessed via a toggle in the filter menu. Also the version number can be added to the table view display via the Show/Hide Columns menu on the top right of the screen.
In general, calibrated deliveries will follow the versioning scheme of the instrument teams. However calibrated data versions for CaSSIS also follow the same scheme as raw data as ESAC is involved in producing the archive products. CaSSIS derived products, not yet available are likely to be an earlier version. NOMAD has also adopted the ESAC versioning for their deliveries and a bulk delivery of version 3.0 calibrated products is expected soon.

Finding Data: Generally, for FREND, ACS and NOMAD the basic capabilities of the UI are sufficient to locate most observations and a typical search will filter on ExoMars, instrument and date. It should be noted that for NOMAD currently, raw data is not yet separated into single observations with typically 2-3 observations grouped into the same product; at the calibrated level the data are separated. Each CaSSIS observation has a unique identifier which can be used for filtering the group of framelets belonging to that observation. Isolating a CaSSIS observation does require the use of the Advanced Search CQL query and this is detailed in the CaSSIS Quick Start Guide which can be found along with guides for the other instruments at https://issues.cosmos.esa.int/socciwiki/display/PSAPUB1/TGO+Information.

Status and Plans: In this paper we will present the current status of the TGO data within the PSA and planned improvements to the advanced search in the UI to improve user experience. We will also provide some example queries using EPN-TAP.