PSA GEOMETRY COMPUTATION MODULE USING SPICE. A. Montero 1, I. Barbarisi 1, R. Docasal 1, C. Laantee 1, J. Osinde 1, C. Rios 1, J. Ruano 1, J. Saiz 1, S. Besse 1, J. Arenas 1, M. Costa 1, B. Merin 1, C. Arviset 1 and N. Manaud 2, 1 ESA/ESAC, Camino Bajo del Castillo s/n, Urb. Villafranca del Castillo, 28691 Villanueva de la Cañada, Spain, amontero@sciops.esa.int

Introduction: The European Space Agency's Planetary Science Archive (PSA) is the central repository for all scientific and engineering data returned by ESA's Solar System Missions.

There are science use cases that need to search products by geometry, by searching data directly within the datasets. This geometry computation is done by the instruments teams who have the latest knowledge of the instrument, and the expertise to provide a very detailed information of it.

But having into account PDS3 format provides a lot of flexibility to the team to provide their metadata the way they want, we can found there is no homogenization of the parameters provided to the archive.

In order to centralize the geometry computation for products search in the PSA, a computation module has been implemented to provide detailed geometry information for the different missions, instruments and observations stored in the PSA.

SPICE: The computation module is based on SPICE, which is an information system with the purpose of providing to scientists the observation geometry needed to plan scientific observations and to analyze the data returned from those observations. It is comprised of a suite of data files, often called kernels, and software.

SPICE was developed and is maintained by the Navigation and Ancillary Information Facility (NAIF).

PSA Geometry Computation module: The PSA-GEO package has been coded in Python, with enough flexibility to be adaptable to any mission without major software changes.

The computation is performed in 2 steps, the first one is the generation of the B3F files (Body Fixed Frame Frustum) containing the complete geometry information and shape model independent, and the second one is the computation of the relevant geometry parameters identified for the different sensors. Instruments footprints and illumination conditions can be computed using only the B3F file and a shape model file.

SPICE kernels and support is provided at ESA by the ESA SPICE service.

GEOGEN tool: GeoGen is a Python script from the PSA-GEO package, used by the PSA team to generate PDS Product-based observation geometry data files in GeoJSON format for ingestion into the PSA.

The script computes the observation footprints and geometry parameters associated to one or several PDS observational (EDR or DDR) data products. It takes as input a Product List File (PLF) file containing a list of PDS data products with a set PDS keywords required to perform the computation of the observation geometry related to each product.

As SPICE-based application, it uses a simplified detector geometry model allowing the computation of observation geometry for all instruments as long as they have a SPICE detector boresight defined. So called LINE and FRAME detectors require additional variables to be defined in SPICE Addendum IK kernel file. Additional PDS keywords are required in input PLF file to derive the corresponding SPICE detector name and number of data frames.

The script produces as output one GeoJSON file and one B3F file per coverage. A coverage represents a group of observations that have identical target, instrument host, instrument and product type.

A GeoJSON file contains the observation footprint(s) for each product, associated with a set of PSA geometry parameters. The computation can be performed using different target surface models, whose related Digital Shape Model Kernels (DSK) files are also defined for a given mission in the configuration file.

The final goal of the computation of these footprints and geometry parameters, is to store them in a PostgreSQL database, with the PostGIS extension, so the users can perform geospatial searches in the PSA. This can be facilitated through the [1] GIS tool that is currently being developed by the PSA team.

References: [1] Docasal R. et al., (2019) GIS Architecture and Applicability on the Planetary Science Archive (submitted).