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European Space Agency/ESAC (ESA SPICE Service)

ESA SPICE Service: Providing more than orbit and attitude for your data analysis

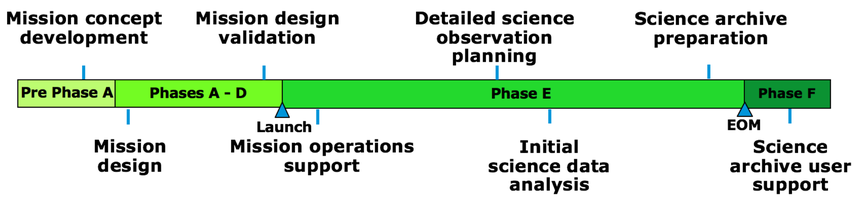
Introduction

SPICE is an information system that uses **ancillary data** to provide Solar System geometry information to scientists and engineers for planetary missions in order to plan and analyze scientific observations from space-born instruments. SPICE is developed and maintained by the Navigation and Ancillary Information Facility (NAIF) team of the Jet Propulsion Laboratory (NASA).

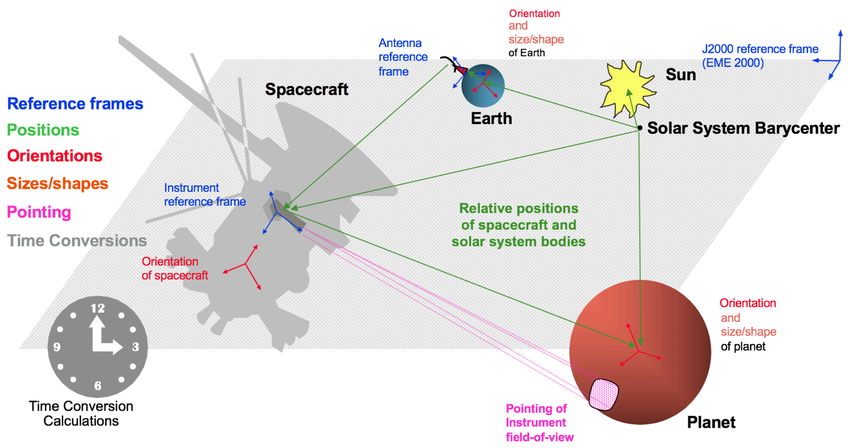
The **ESA SPICE Service (ESS)** leads the SPICE operations for ESA Science and Exploration missions. The group is responsible for the generation, development, maintenance and archive of the SPICE Kernel Datasets for the ESA Planetary Missions

SPICE:

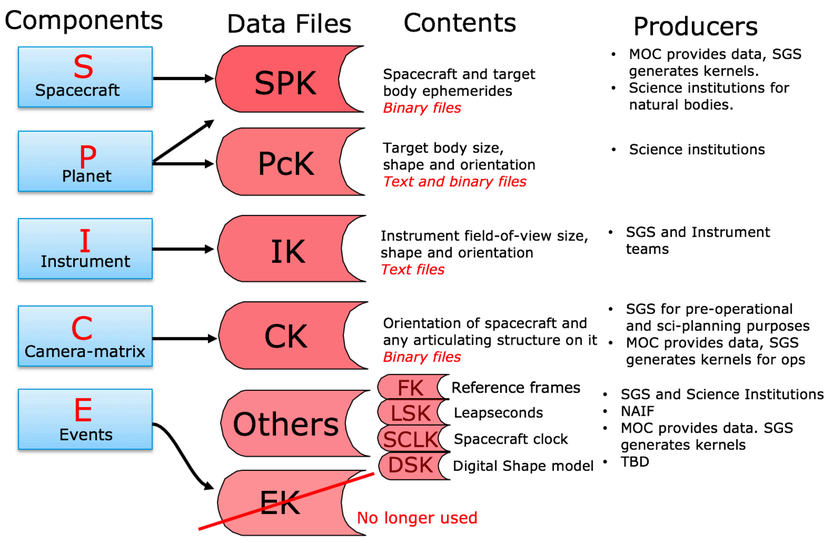
- **Is Used during all the mission phases:**



- **Allows us to instance a mission scenario with:**



- **Its components are:**

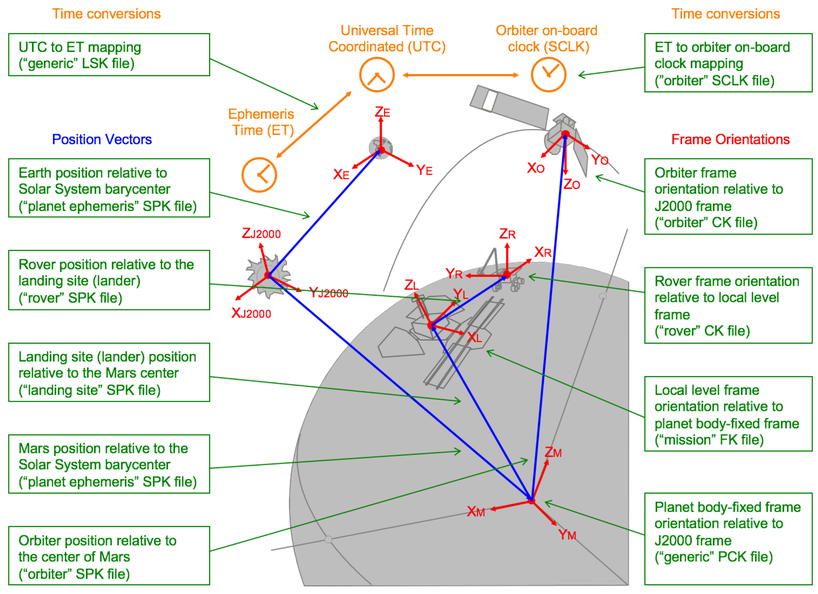


Using SPICE 1.0

SPICE is used to determine observation geometry and events that are important elements of:

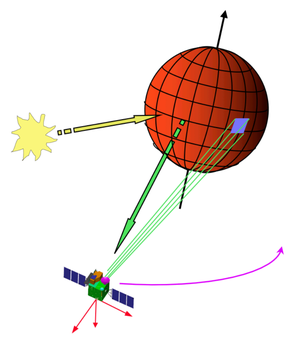
- space mission design,
- selection of observation opportunities,
- analysis of the science data returned from the instruments,
- mission engineering activities, and
- preparation of science data archives.

This graphic depicts the kind of geometry that may be modeled with SPICE:



These figures illustrate a few examples on what the SPICE APIs can provide to a user who uses SPICE within his own program or application:

Compute many kinds of observation geometry parameters at selected times

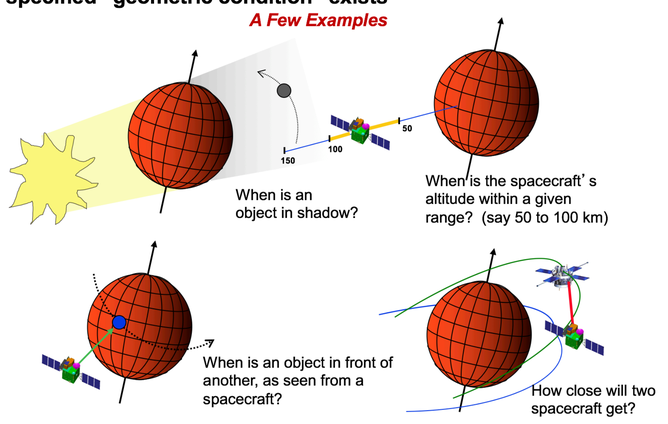


A Few Examples

- Positions and velocities of planets, satellites, comets, asteroids and spacecraft
- Size, shape and orientation of planets, satellites, comets and asteroids
- Orientation of a spacecraft and its various moving structures
- Instrument field-of-view location on a planet' s surface or atmosphere

Find times when a specified "geometric event" occurs, or when a specified "geometric condition" exists

A Few Examples



spiops: a SPICE Python library

spiops is **a Python package** that uses **SpiceyPy** to use SPICE Toolkit APIs to provide higher-level functions than the ones available with SPICE.

spiops is aimed to assists the users to extend the usage of SPICE.
These functions have been identified in my day-to-day work from having to implement multiple times a series of SPICE APIs to obtain a given derived functionality
Functionalities vary from the computation of the illumination of a given Field-of-View to obtaining the coverage of a given S/C for a particular meta-kernel, plotting Euler Angles or comparing different kernels.

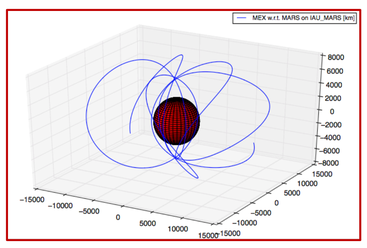
There are three different levels of functions used:

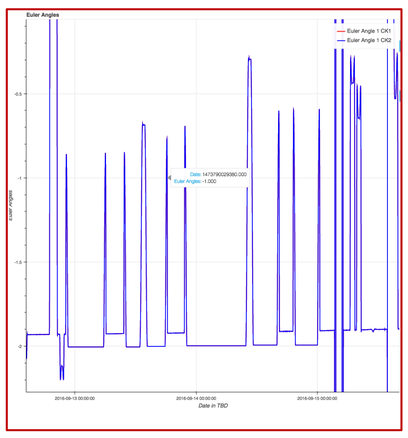
1. SPICE based derived functions
2. non-SPICE based derived functions
3. Object Oriented SPICE interface

The underlying idea of spiops is to be used as a **multi-user and multi-disciplinary pool of re-usable SPICE based functions** and to provide an easier interface to certain SPICE functionalities with objects to provide cross mission and discipline support of SPICE for ESA Planetary and Heliophyisics missions. The ultimate goal is to provide:

1. A Pool for functions that I need to work with SPICE
2. An Interface to provide solutions to users
3. A Library for SPICE-based applications

Available as a PyPi package and accessible via BitBucket.

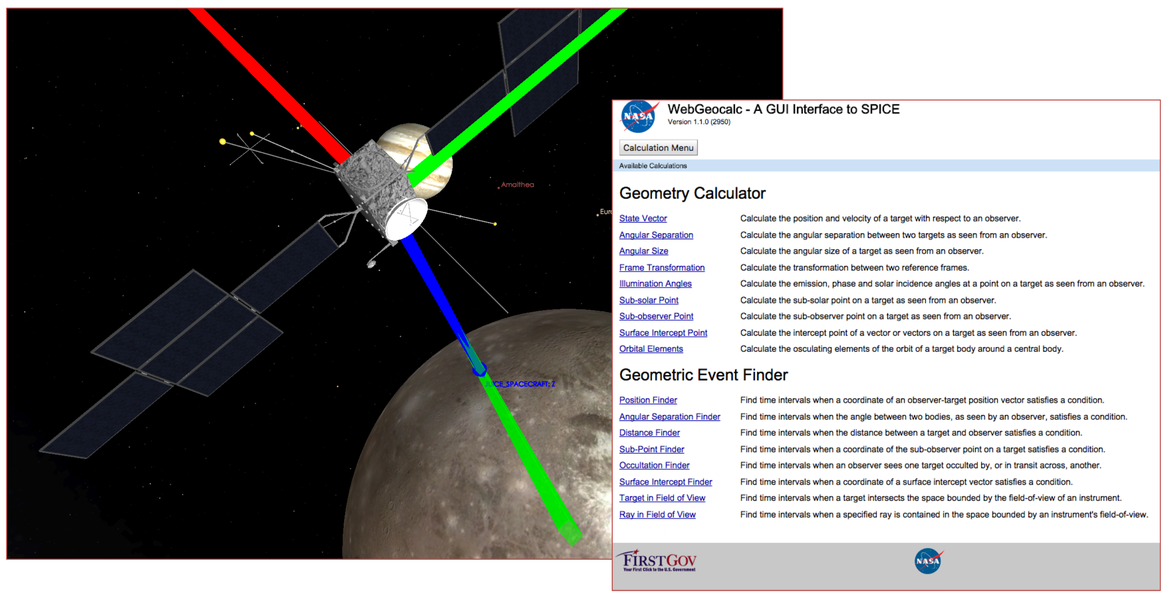




Cosmographia and WebGeocalc

- **WebGeocalc (WGC)** is a web-based graphical user interface to SPICE. It offers many observation geometry computations available in SPICE through a standard web browser. The ESS provides WebGeocalc to support mission planning, mission operations and science data analysis.
- **SPICE-enhanced Cosmographia** is an interactive tool providing 3D visualization of S/C trajectory and orientation, instrument filed-of-view and footprints, and many additional elements of space mission geometry..

Both tools have been proven to have an incredible added value for quick-look analysis, pointing design and contextualization of science data. **ASK FOR A LIVE DEMO!**



References

[1] ESA SPICE Service Home Page: **http://spice.esac.esa.int**
[2] NAIF Home Page: **https://naif.jpl.nasa.gov**
[3] Acton C. (1996), *Space Sci., 44,* 65-70

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