

---

# Aditya-L1 SPICE Archive User Manual

**Manish Gupta, Madhav Haridas MK, Prajesh T**

*Flight Dynamics Group, U. R. Rao Satellite Centre, Indian Space Research Organization (ISRO)*

---

January 3, 2025

This document describes the Aditya-L1 SPICE kernel dataset containing observation geometry and other ancillary data in the form of SPICE System kernels for the Aditya-L1 spacecraft. It describes the dataset directory structure, kernels included in the dataset and their naming conventions.

## 1 Introduction

SPICE (Spacecraft Planet Instrument Camera Events), is an observation geometry information system to assist scientists in planning and interpreting scientific observations from space-based instruments aboard the spacecraft. All the necessary dynamic information required to process the scientific observations from Aditya-L1 are generated as part of the ground segment/Level-0 processes. They are further reviewed, archived and submitted for the publication in the form of a SPICE PDS4 bundle. This archive/bundle includes the set of Aditya-L1 SPICE data files (kernels), which can be accessed using SPICE software. In particular these SPICE kernels provide spacecraft ephemeris, spacecraft attitude and data needed for relevant time conversions. Data in the SPICE kernels must be accessed using the software called the SPICE Toolkit which is produced and distributed by the Navigation and Ancillary Information Facility (NAIF). The next section will brief about the different types of SPICE kernels in this archive.

## 2 Kernel Details

Different types of SPICE kernels are used for storing different kinds of ancillary data. Accordingly, this Archive also contains different types of SPICE kernels providing different kinds of Spacecraft data such as Spacecraft ephemeris, spacecraft attitude, data needed for relevant time conversions etc. The following subsections provide brief details of the various kernel types present in this Archive.

### 2.1 Spacecraft Planet Kernels (SPK)

SPK files contains the ephemeris data for the Aditya-L1 spacecraft. We are providing two kinds of SPK files. For the current month, we provide a daily updating SPK file which is propagated from the recent orbit determination (OD) but which may improve in future. These files are available in Other-Downloads area and not in the main SPICE area, since we are expecting

more improvements in this data in future. Once we have the best OD for a month (OD cycle is 15 days), the propagated monthly file for that month is available in the SPICE area. So, the SPICE area will have the previous month files (but not the current month) and these are our most accurate files. These are uploaded as monthly files where each file is having data of a particular month. XML labels for SPK kernels are also provided. Note that the NAIF assigned object id for Aditya-L1 spacecraft is –156

The naming convention followed for SPK files of Aditya-L1 as part of this PDS4 archive is

al1\_eph\_DDMMYYYY\_ddmmmyyyy\_vX.bsp, where,

DDMMYYYY - start date of SPK data

ddmmmyyyy - end date of SPK data

X - version number of the data

So, these kernels follow 3-character alphabetic month notation and 4-character year notation.

Note that for every monthly file, we also give a 2-3 days extra data both at start and end of the month. For example, the verified monthly files (in SPICE area) for the months of Dec 2023, July 2024 and August 2024 will have the following names respectively

1. al1\_eph\_29Nov2023\_02Jan2024\_v1.bsp,
2. al1\_eph\_29Jun2024\_02Aug2024\_v1.bsp,
3. al1\_eph\_29Jul2024\_03Sep2024\_v1.bsp,

The meta-deta XML files for these kernels are also available

## 2.2 Camera-Matrix Kernels (CK)

CK files contain time varying attitude data for the Aditya-L1 spacecraft. We are providing two kinds of CK files. For the current month, we provide a daily updating CK file which is constructed from the downloaded Auxiliary data for spacecraft attitude. While we aim for continuous gap-free data, there are instances wherein some issues in the Auxiliary data download or processing can lead to gaps in the latest attitude data. However, these gaps are filled later on after more data download/processing/analysis. Hence, these current month files are available in Other-Downloads area and not in SPICE area as we are expecting more improvements in future. Once we have the continuous and optimal file for a month, that file is pushed to the SPICE area. So, the SPICE area will have the previous month files (but not the current month) and these are our most optimal files with best coverage. These are uploaded as monthly files with each file having data of a particular month. XML labels for the CK kernels are also provided. The NAIF ID for the Aditya-L1 Spacecraft scanning platform is –156001.

The naming convention followed for CK files of Aditya-L1 as part of this PDS4 archive is

al1\_att\_DDMMYYYY\_ddmmmyyyy\_vX.bc, where,

DDMMYYYY - start date of CK data

ddmmmyyyy - end date of CK data

X - version number of the data

So, these kernels follow 3-character alphabetic month notation and 4-character year notation.

Note that for every monthly file, we also give a 2-3 days extra data both at start and end of the month. For example, the verified monthly files (in SPICE area) for the months of Dec 2023, July 2024 and August 2024 will have the following names respectively

1. al1\_att\_28Nov2023\_02Jan2024\_v1.bc,
2. al1\_att\_28Jun2024\_02Aug2024\_v1.bc,
2. al1\_att\_28Jul2024\_03Sep2024\_v1.bc,

The meta-data XML files for these kernels are also available

## 2.3 Spacecraft Clock Kernels (SCLK)

SCLK files contain on-board clock calibration data required to perform a transformation between Ephemeris time (ET) and spacecraft on-board time (SCLK). XML label for the SCLK file is also provided. Naming convention followed for SCLK files of Aditya-L1 as part of this PDS4 archive is

al1\_sclk\_vX.tsc, where,  
X - version number of the data

The meta-data XML labels for all these kernels are also available.

## 2.4 Other Kernels

Apart from the above mentioned kernels, this archive also contains the Leapseconds Kernel (LSK) and the Planetary Constants Kernel (PCK). LSK files contain the leapseconds and the values of other constants required to perform a transformation between Universal Time Coordinated (UTC) and Ephemeris time (ET). PCK files contain physical, dynamical and cartographic constants for target bodies. These files are taken from the NAIF website and more details about these can be referred from the NAIF website. Also, one can download additional generic kernels (such as planetary ephemeris kernel : de430.bsp etc) from the NAIF website for analysis purposes.