

New Horizons Alice Pluto Encounter Raw Data Overview

During the migration to the Planetary Data System's (PDS) PDS4 data standards, this current description was adapted from the PDS3 dataset catalog file, including updates found in the KEM1 Encounter phase version, providing light edits to the text, format, flow, and to make the description to better conform to this PDS4 data collection.

Abstract

This data set contains Raw data taken by the New Horizons Alice Ultraviolet Imaging Spectrograph instrument during the PLUTO ENCOUNTER mission phase.

Changes since the prior versions include the addition of data downlinked between the end of January, 2016 and the end of October, 2016, completing the delivery of all data covering the Pluto Encounter and subsequent Calibration Campaign. It includes multi-map and Lyman-alpha observations of Pluto and Charon, histograms of the Pluto system moons, and a number of calibration observations of Rho Leo and other stars.

Also, updates were made to the calibration files, documentation, and catalog files. The data were re-run through the updated pipeline, which changed the FITS headers of the raw data set, but not the FITS data. The updated Effective Area calibration file changed the calibrated data.

These data were migrated from the previously released PDS3 data set NH-P-ALICE-2-PLUTO-V3.0.

Data Set Overview

This data set contains Raw data taken by the New Horizons Alice Ultraviolet Imaging Spectrograph instrument during the PLUTO ENCOUNTER mission phase. The closest approach to Pluto occurred on July 14, 2015, at approximately 11:50 UTC.

PERSI-Alice (P-ALICE; also ALICE) is a spectrograph on the New Horizons spacecraft that is sensitive to extreme and far UltraViolet (UV) light (520-1870 Angstroms). The ALICE instrument comprises a telescopic optics section and a spectrograph section that includes a diffraction grating and a photosensitive two-dimensional (2-D) detector. The optics and diffraction grating physical arrangement configure one detector dimension as a spatial dimension and the other as spectral. ALICE has two separate entrance apertures that feed light to the telescope section of the instrument: the AirGlow Channel (AGC) aperture; the Solar Occultation Channel (SOCC) aperture. Both apertures pass light to the detector through a lollipop-shaped slit comprising two contiguous sections: a narrow, rectangular slit with a Field Of View (FOV) of 0.1 by 4.0 degrees; a fat, square slit with FOV 2.0 x 2.0 degrees. ALICE has three data-taking modes: PixelList mode records each detector/photon event location (pixel, i.e., spectral and spatial), interleaved with time sequence events (hacks), allowing sub-second resolution of the photon events; histogram mode summarizes the per-pixel photon event counts into a 2-D histogram

over all detector pixels, collected over an extended time which can range from a few seconds to several days; High-Cadence CountRate (HCCR) mode stores only the number of detector/photon events recorded during each regular sampling interval that can be chosen from 0.02 seconds up to 4.96 seconds, yielding a time series of global detector event count rate. From both PixelList and histogram modes, the common data product is the histogram (derived on the ground in the PixelList case), which is functionally equivalent to a spectral-by-spatial spectrogram (2-D image); High-Cadence CountRate mode discards all spatial and spectral information. Other data products are also provided and described in this data set.

During the Pluto Charon Encounter mission phase starting in January, 2015, there were several sub-phases: three Approach sub-phases, (AP1, AP2 and AP3); a CORE sequence for the Pluto flyby on 14 July, 2015 (Day Of Year 195), sometimes also referred to as NEP (Near-Encounter Phase); three Departure sub-phases (DP1, DP2, DP3); a Transition sub-phase closing out the encounter mission phase and ending in late October, 2016. For this final ALICE delivery for the Pluto mission phase, this data set includes Approach, CORE, Departure, and Transition sequences' data that was downlinked through late October, 2016.

The first Pluto dataset delivery for the P-Alice instrument covers the data on the ground between 1/15/2015 and 7/31/2015. It includes functional testing and preliminary observations made during approach, as well as a selected few observations from the few days up to the Pluto encounter closest approach. Rho_Leo and Alice_Func are instrument functional and calibration tests. PC_AIRGLOW is an observation that was repeated regularly over the 2 months leading up to the CORE sequence. The VISUV_MAP, Multi_Map, Airglow_Appr, and Airglow_Held observations are part of the prime science data sets that meet specific objectives of the mission.

Every observation provided in this data set was taken as a part of a particular sequence. For this data set, these sequences can be found in the Alice document collection under PDS4 LID `urn:nasa:pds:nh_documents:alice:seq_alice_pluto`. Please note that some sequences provided may have zero corresponding observations. Below is a brief description of some of these sequences related to this mission phase.

[Alice_Rho_Leo](#)

This observation points the P-Alice airglow boresight to the sky location of Rho Leo to meet the following objectives:

- 1) Quick flux sensitivity verification,
- 2) Airglow pointing verification,
- 3) Detector PHD determination.

There are the two observations included:

- Unsaturated PHD observation, a single 30 second Histogram, and a
- Rho-Leo observation, another single 300 second Histogram.

Alice_Func_080

This observation is the standard functional wake up Check (HK-TM, Modes, Checksums and Selftest) with the following objectives:

- 1) Verify some very basic operations after the instrument has been deactivated for some period of time (>month),
- 2) Verify unchanged code (PROM and EEPROM),
- 3) Verify successful parameter load and values,
- 4) Verify successful completion of internal selftest,
- 5) Verify unchanged behavior of the pixelhack problem
- 6) Perform a standard door performance test run

PC_AIRGLOW 2.1-1.4

This set of observations is the P-Alice airglow observation of Pluto in histogram mode. Each observation includes 6, 600 second histograms with Pluto and Charon in the long and narrow portion of the slit. If you visualize the slit as being the shape of a lollipop, the long and narrow portion of the slit would correspond to the stick of the lollipop. This region is known as the 'slot'.

They meet a goal to determine the time variability of Pluto's surface and atmosphere, and the airglow variability over several rotations. The long-time base of this observation is to look for variability in Pluto's atmosphere or excitation mechanisms. Deep histograms are obtained roughly daily over a few set intervals on approach to document and study the variability of atmospheric airglow emissions from H, O, and N atoms/ions, N₂ and CO band emissions, and to search for other emissions such as from S, Ar, and Ne atoms. Pluto will not be resolved, but it is possible that extended emission in the system could be seen, though model brightness estimates indicate this is unlikely. Models predict emission brightnesses of 0.01 to a few Rayleighs.

PC_PIXELLIST

Functional test of P-Alice, with a few minutes of data using Pixel list.

UNOCC_SUN

Unocculted sun observation.

A series of different exposures, 1 histogram for each, at 1, 10, 100, and 1000 seconds. This is a histogram instead of PixelList, but otherwise, it uses the same orientation, observation setup, and same instrument parameters (voltage, etc) as P_OCC.

PC_VISUV_MAP

PEAL_01_PC_VISUV_MAP_B_12 is a 40 minute P-Alice Histogram on Pluto and Charon in the P-Alice box, taken 15 days before closest approach. For these types of observations taken less than 10 days before closest approach, Pluto and Charon are targeted in the slot. The goal is: Color and Composition of Non-Encounter Hemispheres of Pluto & Charon. The scientific motivation is to document the rotational disk-integrated UV lightcurves of Pluto and Charon, primarily for surface composition, and to search for spectral features indicative of surface

materials such as H₂O-ice. It is expected that only the longer wavelengths will have small enough opacity to see Pluto's surface, based on current (1992-2007) gaseous CH₄ observations.

[PC_Multi_Map_A/B](#)

Multi_Map_A5 has 4, 600 second P-Alice Airglow histograms with Pluto in the box, similar to PC_VISUV_MAP. These observations are all multiple 300 second Airglow histograms, similar to PC_VISUV_MAP. For the Multi_Map_B observations, Pluto is aligned in the center of the slot. All of the PC_Multi_Map observations have the same goals as PC_VISUV_MAP.

[PC_Airglow_Appr](#)

There were 5 total of these observations, with Appr_3 and Appr_4 being the last 2, taken a few hours before closest approach.

PC_Airglow_Appr_3 has 10, 300 second histograms, and PC_Airglow_Appr_4 has 18, 150 second histograms. They meet a number of primary mission goals. In addition to the goals for PC_VISUV_MAP and PC_Multi_Map, these measurements also can be used for Pluto/Charon Hemisphere Surface Composition Maps, to determine Pluto's Atmospheric Composition (N₂, CO, CH₄, Ar), and the secondary goal of searching for emissions from minor species (e.g., H, or perhaps C) in the airglow spectra.

The observations provide the best practical S/N on the airglow and information on its spatial distribution with both dayglow and nightglow. Airglow observations from Pluto are very weak, but are expected to provide the primary means for detecting certain minor atmospheric species, including Ar and CO. Typical expected limb brightnesses are a few Rayleighs or less, with the exception of H Lyman alpha, which is expected to be 50-100 Rayleighs (note that this should be darker than the background interplanetary signal from H Lyman alpha, which should be ~100-200 Rayleighs). Most of these emissions are excited by photoelectron impact (peaking in emission rate at ~1000 km altitude), and modeling the observed emissions will yield density estimates for the parent species. It is important to note that N⁺ emissions result from dissociation/ionization/excitation of N₂, and provide no information regarding Pluto's ionosphere.

The observations can also be used to generate Pluto- and Charon-resolved UV surface maps. P-Alice is used for surface composition studies of the sunlit face of Pluto, mostly looking for H₂O, and the instrument is used as a backup for LEISA composition mapping. Water ice and certain other frosts have FUV absorption bands that could be detected by making albedo maps. These observations can also provide the disk-integrated rotationally resolved UV light curves of Pluto and Charon, in support of surface composition studies.

Any additional Alice airglow or H Lyman alpha coronal data would be useful for investigating atmospheric composition. Most of the near encounter observations are designed for high-resolution surface studies. Although the Alice instrument has poor spatial resolution, its time-tagging ability makes it very flexible at taking useful data whenever there is an opportunity (i.e., whenever MVIC, LEISA, or REX are making primary observations).

[P_Alice_Airglow_Held](#)

These observations are Alice airglow observations of Pluto in held histogram mode, taken just before closest approach. Held_1 is 180 seconds, and Held_2 is 65 seconds. In addition to the goals from PC_Airglow_Appr, these observations see the Pluto airglow at the limb. As with the near-encounter airglow observations, these limb observations are to ensure we obtain spatially-resolved airglow data. At the bright limb, Pluto's airglow emissions should be ~10x brighter due to the extended path length.

[Version History](#)

Each subsection below details the major changes between the prior versions of this data set, listing the newest versions before older versions.

[PDS4 v1.0 \(migration from PDS3 V3.0\)](#)

This data collection was migrated from Planetary Data System's (PDS) PDS3 archive standards to the PDS4 archive standards, which involved changing the PDS formatted product labels. The products themselves have remained unchanged. The major changes from the PDS3 V3.0 data set are:

- the calibration files, documents, and data products were reorganized into separate collections of calibration files, documents, and data products, instead of being in a single package as it was in prior PDS3 data set versions.
- the geometry keyword values found within the PDS4 labels were calculated using the most recent SPICE kernels available at label creation. Note that the FITS headers have not been updated and their geometry keyword values therefore remain unchanged.
- the PDS4 data labels were produced using the PDS3 data labels and/or FITS headers, and so any fixes and/or updates to the PDS3 label pipeline as found in future mission phases may not have been implemented here.

[PDS3 V3.0 \(NH-P-ALICE-2-PLUTO-V3.0\)](#)

This is VERSION 3.0 of this data set. This P3 Pluto Encounter dataset release includes all data from the previous two Pluto deliveries and adds data that was downlinked from 1/31/2016 through 10/31/2016. This dataset completes delivery of all data covering the Pluto Encounter and subsequent Calibration Campaign.

Also, updates were made to the calibration files, documentation, and catalog files. The data were re-run through the updated pipeline, which changed the FITS headers of the raw data set, but not the FITS data. The updated Effective Area calibration file (pa_aeff_007.tab) changed the calibrated data.

As of V3.0, targets for some stars and radio sources have been updated so that the TARGET_NAME keyword in the label is accurate and more descriptive than only STAR or CALIBRATION. However the user should confirm that targets from the data FITS files, if applicable for a given instrument, match the label name, as there are a few instances where the FITS keywords for TARGET, SPCCBTNM, and PNTMTHD are not accurate. The simplest way to

check is to instead look at the RA and Dec in the keywords SPCBRRA and SPCBRDEC in the FITS file. This issue mostly only occurs with star targets.

PDS Citation Information: Stern, A., NEW HORIZONS RAW ALICE PLUTO ENCOUNTER V3.0, NH-P-ALICE-2-PLUTO-V3.0, NASA Planetary Data System, 2018.

[PDS3 V2.0 \(NH-P-ALICE-2-PLUTO-V2.0\)](#)

This is VERSION 2.0 of this data set. This P2 Pluto Encounter dataset release provides updates to the Pluto dataset between P1 (data on the ground by 7/31/2015) and P2 (data on the ground by 1/31/2016). All liens from the initial Pluto delivery have also now been resolved. For ALICE it contains only data from the Pluto Encounter period. Of note, the Pluto and Charon occultations are now included and can be found in the PEAL_01_Pocc, PEAL_01_PoccEgress, and PEAL_01_Cocc observations. The start and stop MET's for these observations are below:

Name	Start MET	Stop MET
PEAL_01_Pocc	299,182,045	299,184,153
PEAL_01_PoccEgress	299,184,311	299,186,689
PEAL_01_Cocc	299,187,716	299,191,645

PDS Citation Information: Stern, A., NEW HORIZONS RAW ALICE PLUTO ENCOUNTER V2.0, NH-P-ALICE-2-PLUTO-V2.0, NASA Planetary Data System, 2016.

[PDS3 V1.0 \(NH-P-ALICE-2-PLUTO-V1.0\)](#)

This is VERSION 1.0 of this data set. This first Pluto dataset delivery for the P-Alice instrument covers the data on the ground between 1/15/2015 and 7/31/2015. It includes functional testing and preliminary observations made during approach, as well as a selected few observations from the few days up to the Pluto encounter closest approach.

Liens were never resolved for this data set version but will be in the next version.

Citation Information: Stern, A., NEW HORIZONS RAW ALICE PLUTO ENCOUNTER V1.0, NH-P-ALICE-2-PLUTO-V1.0, NASA Planetary Data System, 2016.

[General statement about data set versions after V1.0](#)

The pipeline (see Processing below) was re-run on these data for each version since the first (V1.0). A pipeline rerun usually changes the FITS headers but not the FITS data of raw data sets. In some cases, calibrated FITS data may change because the calculated geometry of an observation has changed. See data set version-specific sections above for significant exceptions to this general statement, i.e., changes to pipeline processing, calibration processing, and data delivered.

An all-instrument Calibration Campaign occurred in July 2016. For most instruments, calibrations were updated as of April 2017 which changed the data in the calibrated data sets. Calibration changes are described in the data set version-specific sections.

Note that even if this is not a calibrated data set, calibration changes are listed as the data will have been re-run and there will be updates to the calibration files, to the documentation and to the steps required to calibrate the data.

Processing

The data in this data set were created by a software data processing pipeline on the Science Operations Center (SOC) at the Southwest Research Institute (SwRI), Department of Space Operations. This SOC pipeline assembled data as FITS files from raw telemetry packets sent down by the spacecraft and populated the data labels with housekeeping and engineering values, and computed geometry parameters using SPICE kernels. The pipeline did not resample the data.

Data

The observations in this data set are stored in data files using standard Flexible Image Transport System (FITS) format. Each FITS file has a corresponding detached PDS label file, named according to a common convention. The FITS files may have image and/or table extensions. See the PDS label plus the document collection for a description of these extensions and their contents.

This Data section comprises the following sub-topics:

- Filename/Product IDs
- Instrument description
- Other sources of information useful in interpreting these Data
- Visit Description, Visit Number, and Target in the Data Labels

Filename/Product IDs

The filenames and Local product Identifiers (LID) of observations adhere to a common convention, e.g.:

ApIDs	Data product description/Prefix(es)
0x4b0	ALICE PixelList Lossless (CDH 1)/ALI
0x4b1	ALICE PixelList Packetized (CDH 1)/ALI
0x4b4	ALICE PixelList Lossless (CDH 2)/ALI
0x4b5	ALICE PixelList Packetized (CDH 2)/ALI
0x4b2	ALICE Histogram Lossless (CDH 1)/ALI
0x4b3	ALICE Histogram Packetized (CDH 1)/ALI
0x4b6	ALICE Histogram Lossless (CDH 2)/ALI
0x4b7	ALICE Histogram Packetized (CDH 2)/ALI
0x4c0	ALICE High-Cadence CountRate Lossless (CDH 1)/ALI
0x4c1	ALICE High-Cadence CountRate Packetized (CDH 1)/ALI
0x4c4	ALICE High-Cadence CountRate Lossless (CDH 2)/ALI
0x4c5	ALICE High-Cadence CountRate Packetized (CDH 2)/AL

Note 1: CDH 1 and CDH 2 refer to the spacecraft redundant Command and Data Handling systems in general, and here specifically to their respective Solid State Recorders (SSRs) 1 and 2, where Alice data be stored and prepared for downlink. Alice can send data to SSR 1 or to SSR 2, or, for mission-critical data, to both redundantly. Alice shares its channel to the SSRs with the Long-Range Reconnaissance Imager (LORRI), so both instruments cannot store data simultaneously. Alice has the capability to store histogram data to instrument-internal storage, and to transfer it to the SSR(s) later; such an operation is called a Held Histogram, and it allows Alice to take data at the same time that LORRI is taking and writing data to the SSR(s).

Note 2: Packetized (i.e. uncompressed in PDS4) and Lossless refer to the method used on-board to convert raw, high-speed instrument data on the SSR to low-speed data ready for downlink. The conversion process is generally referred to as compression, even though Packetized conversion does not reduce the data volume. In practice, PixelList data always use Packetized compression. Histogram and High-Cadence CountRate (HCCR) data may use Packetized or Lossless compression. Depending on the actual data contents, Lossless compression reduces Histogram data volume by 60 to 90% or more; for nominal science data a factor of 3 or more is normal. Tests show HCCR data do not compress much. Lossless compression is used whenever possible to reduce downlink data volume. There is no difference, between Packetized and Lossless compression, in the resultant FITS files after processing by the Science Operations Center (SOC) data pipeline.

There are other ApIDs that contain housekeeping values and other values. See the SOC Instrument ICD for more details: [urn:nasa:pds:nh_documents:mission:soc_inst_icd](https://nasa.gov/pds/nh_documents/mission/soc_inst_icd)

Please note that not all ApIDs may be found in this data set.

[Instrument description](#)

Refer to the following files for a description of this instrument.:

- New Horizon Alice instrument overview:
[urn:nasa:pds:nh_documents:alice:alice_inst_overview](https://nasa.gov/pds/nh_documents/alice/alice_inst_overview)
- Alice Space Science Review (SSR) paper:
[urn:nasa:pds:nh_documents:alice:alice_ssr](https://nasa.gov/pds/nh_documents/alice/alice_ssr)

- SOC Instrument ICD: `urn:nasa:pds:nh_documents:mission:soc_inst_icd`
- Alice SPICE Instrument Kernel: `urn:nasa:pds:nh_documents:alice:nh_alice_ti`

Other sources of information useful in interpreting these Data

Refer to the following files for more information about these data:

- NH Mission Trajectory Table:
`urn:nasa:pds:nh_documents:mission:nh_mission_trajectory`
- Field of View Illustration: `urn:nasa:pds:nh_documents:mission:nh_fov`
- Alice SPICE Instrument Kernel: `urn:nasa:pds:nh_documents:alice:nh_alice_ti`

Visit Description, Visit Number, and Target in the Data Labels

The observation sequences were defined in Science Activity Planning (SAP) documents and grouped by Visit Description and Visit Number. The SAPs are spreadsheets with one Visit Description & Number per row. A nominal target is also included on each row and included in the data labels but does not always match with the target name field's value in the data labels. In some cases, the target was designated as `right_ascension_angle`, `declination_angle` pointing values in the form "`right_ascension_angle`, `declination_angle` =123.45,-12.34" indicating Right Ascension and Declination, in degrees, of the target from the spacecraft in the Earth Equatorial J2000 inertial reference frame. This indicates that either the target was a star, or the target's ephemeris was not loaded into the spacecraft's attitude and control system which in turn meant the spacecraft could not be pointed at the target by a body identifier and an inertial pointing value had to be specified as Right Ascension and Declination values. PDS-SBN practices do not allow putting a value like `right_ascension_angle`, `declination_angle` =... in the PDS target name keyword's value. In those cases, the PDS target purpose value is set calibration. Target name may be None for a few observations in this data set; typically, that means the observation is a functional test so None is an appropriate entry for those targets, but the PDS user should also check the `nh:observation_description` and `nh:sequence_id` keywords in the PDS label, plus the provided sequence list (`urn:nasa:pds:nh_documents:alice:seq_alice_pluto`) to assess the possibility that there was an intended target. These two keywords are especially useful for star targets as often stars are used as part of instrument calibrations and are included as part of the sequencing description which is captured in these keywords.

Specifically for Alice observations, any observation that has an observation description or sequence ID that includes the words dump or held will usually have None as its target, but that indicates the observation was actually taken as part of an earlier sequence and held locally in instrument memory (i.e. a Held Histogram; see the Notes in the Data section below), and the Dump sequence represents the commands that transferred the instrument data onto the spacecraft Solid-State Recorders (SSRs). In the cases of Held Histograms, the user should check the previous sequence in the sequence list. For other cases note that if the characters `_P_`, `_C_`, or `_PC_` are in the sequence ID, then the intended target was likely Pluto, Charon, or Pluto and Charon together, respectively.

Ancillary Data

The geometry items included in the data labels were computed using the SPICE kernels archived in the New Horizons SPICE data set, NH-J/P/SS-SPICE-6-V1.0.

Every observation provided in this data set was taken as a part of a particular sequence. A list of these sequences has been provided within the NH Alice document collection (see PDS4 LID `urn:nasa:pds:nh_documents:alice`) within the PDS, one file for each mission phase. The sequence identifier and description are included in the PDS label for every observation.

N.B. While every observation has an associated sequence, every sequence may not have associated observations. Some sequences may have failed to execute due to spacecraft events (e.g., safing). No attempt has been made during the preparation of this data set to identify such empty sequences.

Time

There are several time systems, or units, in use in this dataset: New Horizons spacecraft MET (Mission Event Time or Mission Elapsed Time), UTC (Coordinated Universal Time), and TDB (Barycentric Dynamical Time).

This section will give a summary description of the relationship between these time systems. For a complete explanation of these time systems the reader is referred to the documentation distributed with the Navigation and Ancillary Information Facility (NAIF) SPICE toolkit from the PDS NAIF node, (see <http://naif.jpl.nasa.gov/>).

The most common time unit associated with the data is the spacecraft MET. MET is a 32-bit counter on the New Horizons spacecraft that runs at a rate of about one increment per second starting from a value of zero at “19.January, 2006 18:08:02 UTC” or “JD2453755.256337 TDB.”

The leapsecond adjustment ($\Delta_{ET} = ET - UTC$) was 65.184s at NH launch, and the first four additional leapseconds occurred at the ends of 12/2009, 06/2012, 06/2015, and 12/2016. Refer to the NH SPICE data set, NH-J/P/SS-SPICE-6-V1.0, and the SPICE toolkit documentation, for more details about leapseconds.

The data labels for any given product in this dataset usually contain at least one pair of common UTC and MET representations of the time at the middle of the observation. Other portions of the products, for example tables of data taken over periods of up to a day or more, will only have the MET time associated with a given row of the table.

For the data user's use in interpreting these times, a reasonable approximation (+/- 1s) of the conversion between Julian Day (TDB) and MET is as follows:

$$JD_{TDB} = 2453755.256337 + (MET / 86399.9998693)$$

For more accurate calculations the reader is referred to the NAIF/SPICE documentation as mentioned above.

Reference Frame

Geometric Parameter Reference Frame

Earth Mean Equator and Vernal Equinox of J2000 (EMEJ2000) is the inertial reference frame used to specify observational geometry items provided in the data labels. Geometric parameters are based on best available SPICE data at time of data creation.

Epoch of Geometric Parameters

All geometric parameters provided in the data labels were computed at the epoch midway between the start_date_time and stop_date_time label fields.

Software

The observations in this data set are in standard FITS format with PDS labels and can be viewed by a number of PDS-provided and commercial programs. For this reason, no special software is provided with this data set.

Confidence Level Overview

During the processing of the data in preparation for delivery with this volume, the packet data associated with each observation were used only if they passed a rigorous verification process including standard checksums.

In addition, raw (CODMAC Level 2) observation data for which adequate contemporary housekeeping and other ancillary data are not available may not be reduced to calibrated (CODMAC Level 3) data. This issue is raised here to explain why some data products in the raw data set may not have corresponding data products in the calibrated data set.

Known Issues

Below is a list of all deficiencies and irregularities that are known to exist at the time of publication.

Alice door position

The <door_position> attribute should, in general, have either the value “Open”, indicating Alice was observing the target, or “Closed”, indicating that Alice was recording a dark observation. The state of the door was reported as part of the housekeeping data. When housekeeping data were not available, the door position was reported as “Unknown”. However, it was noted that about 33% of all observations do not have associated housekeeping, and in some of the remaining observations the door position reported seems to change on a time scale that is not consistent with physical constraints on the door mechanism. These anomalies were not resolved at the time these data were migrated from their PDS3 form. Door position was not reported in the PDS3 labels; the values reported in the PDS4 labels reflect the codes read from the FITS header for the door position.

Data coverage and quality

Every observation provided in this data set was taken as a part of a particular sequence. For this data set, these sequences can be found in the Alice document collection under PDS4 LID `urn:nasa:pds:nh_documents:alice:seq_alice_pluto`. Please note that some sequences provided may have zero corresponding observations.

Refer to the Confidence Level Overview section above for a summary of steps taken to assure data quality.

The lollipop-shaped fuzz in images of some Alice spectra, seen as high signal levels at the box end of the slit around Hydrogen Lyman-alpha (H Ly α) wavelengths, is due to a characteristic of the detector and aperture. To make the Micro Channel Plate (MCP) more sensitive to UV light, it was coated with potassium bromide (KBr) photocathodes from 520 to 1180 Angstrom and with cesium iodide (CsI) photocathodes from 1250 to 1870 Angstrom. A vertical strip - a spectral band of 70 Angstrom centered at ~ 1216 Angstrom - of the MCP was masked and left uncoated to reduce the sensitivity of the detector to H Ly α radiation. In the slit portion of the aperture (0.1deg wide x 4deg high), the diffraction grating keeps the strong H Ly α line within that uncoated band. However, in the 2x2 degree box portion of the aperture designed to capture the Sun during occultations, the H Ly α spreads out beyond the uncoated 70-Angstrom band over another ~ 55 Angstroms of more sensitive photocathode-coated detector on either side. The quantum efficiencies of the photocathode-coated surfaces are about an order of magnitude more sensitive to H Ly α wavelengths than the bare, uncoated glass, which gives rise to high signal levels from the box area of the slit i.e. the lollipop fuzz.

Caveat about target name in PDS labels and observational

The downlink team on New Horizons has created an automated system to take various uplink products, decode things like Chebyshev polynomials in command sequences representing celestial body ephemerides for use on the spacecraft to control pointing, and infer from those data what the most likely intended target was at any time during the mission. This works well during flyby encounters and less so during cruise phases and hibernation.

The user of these PDS data needs to be cautious when using the target name and other target-related parameters stored in this data set. This is less an issue for the plasma and particle instruments, more so for pointed instruments. To this end, the heliocentric ephemeris of the spacecraft, the spacecraft-relative ephemeris of the inferred target, and the inertial attitude of the instrument reference frame are provided with all data, in the J2000 inertial reference frame, so the user can check where that target is in the Field Of View (FOV) of the instrument.

Finally, note that, within the FITS headers of the data products, the sequence tables, and other NH Project-internal documents used in this data set, informal names are often used for targets instead of the canonical names used within the PDS labels. For example, during the Pluto mission phase, instead of the target name '15810 ARAWN (1994 JR1)' there might be found any of the following: 1994JR1; 1994 JR1; JR1. However, within the context of this data set, these project abbreviations are not ambiguous (e.g. there is only one NH target with 'JR1' in its

name), so there has been, and will be, no attempt to expand such abbreviations where they occur outside formal PDS keyword values.

Contact Information

For any questions regarding the data format of the archive, contact the New Horizons Alice Principal Investigator: Alan Stern, Southwest Research Institute

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USA

Further Reading

Steffl, A.J., J. Peterson, B. Carcich, L. Nguyen, and S.A. Stern, NEW HORIZONS SPICE KERNELS, V1.0, NH-J/P/SS-SPICE-6-V1.0, NASA Planetary Data System, 2007.

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