

# New Horizons PEPSSI 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 Pluto Energetic Particle Spectrometer Science Investigation (PEPSSI) instrument during the PLUTO ENCOUNTER mission phase.

This data set contains PEPSSI observations taken during the Approach (Jan-Jul, 2015), Encounter, Departure, and Transition mission sub-phases, including flyby observations taken on 14 July, 2015, and departure and calibration data through late October, 2016. This data set completes the Pluto mission phase deliveries for PEPSSI.

Changes since 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.

Significant changes were made to the PEPSSI packet processing and calibration, too extensive to go into here. Data from all previous data sets should be discarded. Refer to the data set documentation for details about processing of PEPSSI data.

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

## Data Set Overview

This data set contains Raw data taken by the New Horizons Pluto Energetic Particle Spectrometer Science Investigation (PEPSSI) instrument during the PLUTO ENCOUNTER mission phase. The closest approach to Pluto occurred on July 14, 2015, at approximately 11:50 UTC.

PEPSSI (Pluto Energetic Particles Spectrometer Science Investigation) is a particle telescope and a time-of-flight (TOF) spectrometer that measures ions and electrons over a broad range of energies and angles. Particle composition and energy spectra are measured for H to Fe from ~30 keV to ~1 MeV (but not all species are uniquely separated) and for electrons from ~30 keV to 700 keV. PEPSSI comprises a time-of-flight (TOF) section and a solid-state detector (SSD) array that measures particle energy. The combination of measured energy and TOF provides unique particle identification by mass and particle energy depending on the range: for protons from ~30 keV to ~1 MeV; for heavy (CNO) ions from ~80 keV to ~1 MeV. Lower-energy (>3 keV) ion fluxes are measured by TOF only, but without the SSD signal, providing velocity spectra at these

energies as well. Due to storage and bandwidth limitations, all event data cannot be stored or telemetered to the ground. Instead, a round-robin algorithm is used to save Energy, TOF, and timing data for select events. The common data products contain these event and summary measurements, accumulated over fixed periods of 86,400 seconds, with each period in a single file comprising multiple binary tables. A more detailed description of the data format can be found in Science Operations Center (SOC) Instrument Interface Control Document (ICD) (see PDS4 LID [urn:nasa:pds:nh\\_documents:mission:soc\\_inst\\_icd](#)) and the PEPSSI document collection (see PDS4 LID [urn:nasa:pds:nh\\_documents:pepssi](#)).

### Overview of PEPSSI current version of data set

The first-delivered data set included low-time resolution data from Approach, CORE and Departure subphases through the end of July, 2015. It also included two selected periods of high-resolution data from the CORE subphase on the day of Pluto flyby (14 Jul 2015): the first period starts ninety minutes after Pluto closest approach and lasts about forty minutes; the second starts nine hours after closest approach and lasts about fifteen minutes. Early downlink of these two periods of PEPSSI data ensured the instrument satisfied its mission requirements.

The second-delivered data set fills in the periods of high-resolution data at flyby, it also provides ongoing departure observations through the end of January, 2016.

This third- and final-delivered data set fills in the rest of the sequenced high-time resolution encounter data, plus the departure data taken in the months after encounter.

### Overview of PEPSSI data taken during the Pluto Encounter mission phase

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 ending in late October, 2016, closing out the Pluto Encounter mission phase. For this final PEPSSI delivery for the Pluto mission phase, this data set includes the Approach data plus the CORE and Departure sequences' data, as well as normal operation and Calibration Campaign data during Transition, and has all data downlinked through the end of October, 2016.

During the Approach phase, PEPSSI performed functional tests including a memory refresh, and otherwise operated as normal, turning off and on around spacecraft trajectory correction maneuvers, and taking data during a series of plasma rolls, on DOY 107, 115, 121, 128, 148, 156, and 176. There were two other dedicated SWAP and PEPSSI rolls on DOY 163 and 171. PEPSSI was powered on and collecting data throughout the encounter time frame.

PEPSSI was generally turned on and taking data for the Departure and Transition sub-phases, the exceptions being when PEPSSI was turned off during spacecraft events such as 3-axis operations and trajectory correction maneuvers.

Due to a spacecraft safing event on 04 July, 2015 (DOY 185), the balance of the science load from then-executing 15184 sequence (nominal start time on DOY 184 in 2015) was sacrificed to ensure the 15188 CORE load with the flyby sequence could be loaded onto the spacecraft and

started on time. As a result, there is a gap in the PEPSSI data from approximately DOY 186 to DOY 188.

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 PEPSSI document collection under PDS4 LID `urn:nasa:pds:nh_documents:pepssi:seq_pepssi_pluto`. Please note that some sequences provided may have zero corresponding observations.

## 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.

There is a slight overlap of a week or two of data between the end of the Pluto Encounter and the beginning of KEM Cruise 1 PDS3 delivered data sets. No attempt to sort out these data were made during the migration of the PDS3 data sets to the PDS4 standards. Some data files may supersede others. This is due to data being replayed after the Pluto Encounter PDS Deliveries. As a result, the product identifiers (LIDVIDs) may not reflect one product superseding the other. Note that file names may change between deliveries if the start/stop times are updated when additional data were later downlinked.

### PDS3 V3.0 (NH-P-PEPSSI-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.

For PEPSSI, most of the Pluto Encounter data was downlinked in the 15229 load in August 2015. Since then, PEPSSI has stayed on and taken data continuously, other than a few power cycles around spacecraft events such as 3-Axis operations and trajectory correction maneuvers.

Significant changes were made to the PEPSSI packet processing and calibration, too extensive to go into here. Data from all previous data sets should be discarded. Refer to the data set documentation for details about processing of PEPSSI data.

PDS Citation Information: McNutt, R. Jr., NEW HORIZONS RAW PEPSSI PLUTO ENCOUNTER V3.0, NH-P-PEPSSI-2-PLUTO-V3.0, NASA Planetary Data System, 2018.

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

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 PEPSSI, most of the Pluto Encounter data was downlinked in the 15229 load in August 2015. Since then, PEPSSI has stayed on and taken data continuously, other than a few power cycles around spacecraft events such as 3-Axis operations and trajectory correction maneuvers.

PDS Citation Information: McNutt, R. Jr., NEW HORIZONS RAW PEPSSI PLUTO ENCOUNTER V2.0, NH-P-PEPSSI-2-PLUTO-V2.0, NASA Planetary Data System, 2016.

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

This is VERSION 1.0 of this data set. For this first PEPSSI delivery for the Pluto mission phase, this data set includes only the Approach data plus the subset of the CORE sequence data that was downlinked through the end of July, 2015.

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

PDS Citation Information: McNutt, R. Jr., NEW HORIZONS RAW PEPSSI PLUTO ENCOUNTER V1.0, NH-P-PEPSSI-2-PLUTO-V1.0, NASA Planetary Data System, 2016.

#### [General statement about data set versions after the first](#)

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.

Also note that file names may change between versions if start/stop times are updated when additional data are downlinked.

## 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.:

```

pep_0123456789_0x584_eng.fit
^^^^^^^^^^^^^^^^^^^^^^\^^/
|                          |
|                          |
|                          |
|              +---File type (includes dot)
|              - .FIT for FITS file
|              - .LBLX for PDS label
|              - not part of LID
|
|              +---ENG for CODMAC Level 2 data
|              SCI for CODMAC Level 3 data
|
|              +---Application ID (ApID) of the telemetry data
|              packet from which the data come
|              N.B. ApIDs are case-insensitive
|
|              +---MET (Mission Event Time) i.e. Spacecraft Clock
|
+---Instrument designator
```

**Instrument Designator(s):**

Instrument Designator	Description
PEP	PEPSSI

See SOC Instrument Interface Control Document (ICD) within the PDS for more details (PDS4 LID [urn:nasa:pds:nh\\_documents:mission:soc\\_inst\\_icd](#)).

### Mission Event Time (MET)

Note that, depending on the observation, the Mission Event Time (MET) in the data filename and in the LID may be similar to the MET of the actual observation acquisition, but should not be used as an analog for the acquisition time. The MET is the time that the data are transferred from the instrument to spacecraft memory and is therefore not a reliable indicator of the actual observation time. The PDS labels are better sources to use for the actual timing of any observation. The specific keywords for which to look are:

- start\_date\_time
- stop\_date\_time
- start\_clock\_count
- stop clock count

### Application ID (ApID)

Here is a summary of the types of files generated by each ApID (N.B. ApIDs are case-insensitive) along with the instrument designator that go with each ApID:

ApIDs	Data product description/Prefix(es)
0x691	PEPSSI High Priority Science (long integration)
0x692	PEPSSI Medium Priority Science (short integration)
0x693	PEPSSI Low Priority Science (Up to 500 PHA events)
0x694	PEPSSI Low Priority Science (Up to 500 PHA events)
0x695	PEPSSI High Priority Science Diagnostic Mode data
0x696	PEPSSI Medium Priority Science Diagnostic Mode data
0x697	PEPSSI Diagnostic Mode Event data
0x698	PEPSSI Diagnostic Mode Event data

For historical reasons, PEPSSI products always use an ApID of '0x691' in the filename. Each product actually contains all the data types (ApIDs) available for that day.

ApIDs '0x693' and '0x694' are combined during ground processing. So are ApIDs '0x697' and '0x698'.

There may be other ApIDs that contain housekeeping values and other values. See SOC Instrument ICD for more details: [urn:nasa:pds:nh\\_documents:mission:soc\\_inst\\_icd](urn:nasa: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 PEPSSI instrument overview:  
[urn:nasa:pds:nh\\_documents:pepssi:pepssi\\_inst\\_overview](urn:nasa:pds:nh_documents:pepssi:pepssi_inst_overview)
- PEPSSI Space Science Review (SSR) paper:  
[urn:nasa:pds:nh\\_documents:pepssi:pepssi\\_ssr](urn:nasa:pds:nh_documents:pepssi:pepssi_ssr)
- SOC Instrument ICD: [urn:nasa:pds:nh\\_documents:mission:soc\\_inst\\_icd](urn:nasa:pds:nh_documents:mission:soc_inst_icd)
- PEPSSI SPICE Instrument Kernel:  
[urn:nasa:pds:nh\\_documents:pepssi:nh\\_pepssi\\_ti](urn:nasa:pds:nh_documents:pepssi:nh_pepssi_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](urn:nasa:pds:nh_documents:mission:nh_mission_trajectory)
- Field of View Illustration: [urn:nasa:pds:nh\\_documents:mission:nh\\_fov](urn:nasa:pds:nh_documents:mission:nh_fov)
- PEPSSI SPICE Instrument Kernel:  
[urn:nasa:pds:nh\\_documents:pepssi:nh\\_pepssi\\_ti](urn:nasa:pds:nh_documents:pepssi:nh_pepssi_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:pepssi:seq_pepssi_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.

## 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, <https://doi.org/10.17189/1520109>.

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 PEPSSI document collection (see PDS4 LID `urn:nasa:pds:nh_documents:pepssi`) 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, <https://doi.org/10.17189/1520109>, 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.

### Missing product label updates

During the data set migration from PDS3 to PDS4, 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. For instance, column or field names and descriptions may have been updated or corrected in a data set of a later mission phase, but not here.

### Data overlap between mission phases

There is a slight overlap of a week or two of data between the end of the Pluto Encounter and the beginning of KEM Cruise 1 PDS3 delivered data sets. No attempt to sort out these data were made during the migration of the PDS3 data sets to the PDS4 standards. Some data files may supersede others. This is due to data being replayed after the Pluto Encounter PDS Deliveries. As a result, the product identifiers (LIDVIDs) may not reflect one product superseding the other. Note that file names (and therefore the original PDS3 product\_id) may change between deliveries if the start/stop times are updated when additional data were later downlinked.

### 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 PEPSSI document collection under PDS4 LID `urn:nasa:pds:nh_documents:pepssi:seq_pepssi_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.

For PEPSSI, electron detector channels are dominated by cosmic rays in post-Jupiter mission phases.

The PEPSSI data are considered suspect for the first forty minutes after an instrument power-on event, called a Bad Time Interval (BTI); this file lists those time windows. The entire Post-launch commissioning mission phase is also considered a BTI.

Within the PDS, see the SOC Instrument ICD (PDS4 LID `urn:nasa:pds:nh_documents:mission:soc_inst_icd`) and the BTI TABLE file (PDS4 LID `urn:nasa:pds:nh_documents:pepssi:pep_bti`) for more detail. Superseded lists of bad time intervals from phases prior to KEM1 Encounter are also provided within the PEPSSI document bundle (PDS4 LID `urn:nasa:pds:nh_documents:mission`) for completeness and are named according to the phase in which they were produced.

The PEPSSI Time Of Flight only (TOF-only) Pulse Height Analysis (PHA) event data may show differences in the 'N2 data' and 'N3 data' taken simultaneously but using different collection algorithms. Refer to the instrument description in the PEPSSI instrument overview document (PDS4 LID `urn:nasa:pds:nh_documents:pepssi:pepssi_inst_overview`) under 'Data sampling and priority for TOF-only data' in the 'Operational modes' section.

Some subset of the PHA event data is noise or other instrumental artifacts. PHA events with parameters outside the stated instrument sensitivity limits (see the SPECIFICATIONS section in the PEPSSI instrument overview document (PDS4 LID

`urn:nasa:pds:nh_documents:pepssi:pepssi_inst_overview`) should be ignored, or, at the very least, used with extreme caution.

It should be noted that the Primary HDU and the first 5 extension HDUs (the Image HDUs containing spectrograms) of the level 3 data are 'quick-look' or 'browse' products only. They are constructed with one minute averages for the whole mission, so that, if the data collection period (the DT in the table in the FLUX extension) is not an even multiple or factor of 1 minute, the spectrogram image will exhibit aliasing artifacts. Further, the second extension, the Helium spectrogram includes the Alpha source channels (see above). In short, the Image HDUs in the level 3 data are not for scientific use but for browsing or quick-look purposes and for researchers to determine if they are able to correctly read the data in the table extensions.

Data at higher resolution, up to 1 second for the Pluto Encounter time period, can be found in the Flux and PHA Data HDUs. Please see the ICD (PDS4 LID

`urn:nasa:pds:nh_documents:mission:soc_inst_icd`), section 11, and specifically sections 11.2 and 11.4, for details regarding interpreting rates and the timing of events.

Please see the 'Data Validity' section of PEPSSI instrument overview document (PDS4 LID

`urn:nasa:pds:nh_documents:pepssi:pepssi_inst_overview`) for details regarding information on channels which should be excluded from analysis.

## 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 PEPSSI Principal Investigator:

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## 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.

<https://doi.org/10.17189/1520109>