Guide to PDS4 Context Products

Creation, Usage, Best Practices

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07/11/22	Update LID formation rules to reflect practice	M. Tiscareno

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Introduction

The PDS4 archiving standard has introduced the concept of *context products* in order to tie together sets of identifiers for consistent referencing of investigations, missions, facilities, telescopes, instruments, and targets. Context products consist of a system of references necessary for connecting data and documents across the PDS4 bundle/collection structures to known commonly referenced things. There are currently 14 categories of context products managed by the PDS Engineering Node (EN) which can be found at:

https://pds.nasa.gov/data/pds4/context-pds4/

This document will provide information about how context products should be used, including logical identifier (LID) formation, file naming conventions/suggestions, contents, and basic usage guidelines. In general, as is the case across the PDS4 standard, specificity should proceed from left to right with increasing specificity (i.e., a top-down approach). Each category will be described with appropriate suggestions for usage and formation from a top-down perspective paralleling the usage in individual labels. This guide will also provide instructions on submitting new context products to the EN and editing and versioning of current products in the EN Context Bundle when the need arises to add new products or update existing ones.

Context Product Logical Identifiers (LIDs)

The core of all context products is the unique identifier which is referred to as the *logical identifier* (LID). This LID is the most important part of the context product and is the mechanism for connecting all products within the PDS4 system. All LIDs under PDS4 are expressed as Uniform Resource Names (URNs), which provide a unique location-non-specific identifier for every registered product in the PDS4 system. The first 3 segments of the URN provide the resolving institution responsible for maintaining the referenced product. The stem of all context product LIDs should be:

urn:nasa:pds:context:<category>:<type>.<identifier>

Note, context products managed outside of the NASA PDS, may have a different stem indicating another resolving institution. For example, the Planetary Science Archive (PSA) from the European Space Agency (ESA) might have a LID looking like:

urn:esa:psa:context:<category>:<type>.<identifier>

For ease of reference, LIDs used in the rest of this document will reference PDS derived products with the stem, *urn:nasa:pds:context*.

Associations

Use of context products within PDS4 labels is important for bookkeeping the provenance of the associated products. However, it is not likely that a single context product will adequately describe the context in any given situation. Because of this, it is necessary to describe how the system of context products are used but also how the products relate to each other. In the PDS4 context system, each label should provide a chain of context references that tie that product to the particular combination that describes something about how/where that product has been generated. There should be consideration of the contents of these products based on the necessary relationships between them; these are known as associations. These associations provide the connective pointing between the different parts of the context system. Single direction pointing is required and should be accomplished by pointing from investigation to host to instrument to target (in the simplest case) in a top-down fashion. Sometimes, bi-directional pointing is an added benefit idea when describing a unique set of relationships.
An example of this would be for a spacecraft and its instruments. In PDS4, the host product of instrument_host (the spacecraft) will point to the member instruments. Because these instruments are bolted on the spacecraft and then sent to space, the relationship between the spacecraft and the instruments will never change. Instruments that belong to spacecraft typically also point back to the spacecraft host because they designate the unique, immutable relationship. In this case it makes sense to have bi-directional pointing. Targets tend to represent the other extreme. Spacecraft and instruments have targets and all those targets can be listed as possible objects of the scientific study. In this case the target is the general object and it has no relationship back to the individual spacecraft or instruments. The investigations/hosts/instruments may all point to a particular target, but the target has no need to point back to those other pieces. Hence targets tend to have top-down single direction pointing.

Associations are formulated using the tag <reference_type> and may have set relationships that point from the current product to the referenced product (e.g., bundle_to_document, collection_to_data, etc.). As each type of product is described below, there will be recommendations as to what those reference type associations would be. In many cases if the product is specifically part of the observing system, which will be likely for context products, the value will simply be, is_instrument_host, is_instrument, is_telescope, etc. For the full enumerated listing, the values will be given under the <reference_type> tag for the version of the IM that is being used. There are slight differences in this list over multiple versions of the IM, so it is always a good idea to double check the list if you are unsure of what fits. Oxygen (and other XML editors) may give on-the-fly validation and provide you with the appropriate list depending on the usage.

Investigation Context Products

Investigation products allow data to be grouped with a common theme. Investigation products represent the top level of the context system and serve as the initial step in determining the function of the system of context references for the project you are creating.

LID construction follows the form:

urn:nasa:pds:context:investigation:<investigation_type>.<identifier>

where the <investigation_type> being either ***mission***, ***observing_campaign***, ***field_campaign, individual_investigation***, and ***other_investigation,*** and <identifier> defined to ensure the LID is unique.

Mission

Mission investigations allow different data and documentation to be tied to a mission. For example data collected with or derived from the *Cassini Orbiter* or *Huygens Probe* will reference the Cassini-Huygens mission investigation product:

urn:nasa:pds:context:investigation:mission.cassini-huygens

Under this example any data that was originally collected (raw) or processed (calibrated, partially-processed, reduced) or derived from this original mission source should reference their connection to the Cassini-Huygens mission investigation. Mission investigation products are usually created with the submission of the first data from a mission. Therefore, any submission of mission-related products after the mission will already have this context product available via the EN Context Bundle website.

Observing Campaign

Observing Campaign investigations will usually reference telescopic observations of a target or set of targets either for support of missions or as a primary study of the target. Most of the time, these data will make use of ground-based observatories/telescope/instrument combinations for a unified purpose. For example ground-based observations in support of Jupiter-bound missions might have an observing campaign comprised of telescopic observations of Jupiter over time for the purpose of providing context observations related to a mission or group of missions. One example of a LID for this situation for Jupiter support could be:

urn:nasa:pds:context:investigation:observing_campaign.jupiter_support

Under this example multiple data providers could submit data with this observing campaign investigation product if their primary purpose was for support observations of Jupiter.

Field Campaign

Field Campaign products are used to describe terrestrial field work used for comparative planetary analog studies. Field campaigns will typically be tied to a specific location or locations, with a unified scientific purpose. Such purposes would include but are not limited to physical processes, surface/atmospheric chemistry, pressure/temperature comparisons, geomorphology and environmental limitations, etc. Field campaigns are useful for setting limits on planetary processes/environments based on accessible similar processes on Earth that can be readily tested. For example, dust devils on Earth and Mars form in nearly identical ways. Terrestrial field studies of dust devils are helpful in determining limitations of the same process on Mars. Field work collected in Eldorado Valley, Nevada (2015), for example, is very applicable to limited data collected by landers and rovers on Mars. The location and type of science could be described in the LID like:

urn:nasa:pds:context:investigation:dfield_campaign.dd_eldorado_nv_2015

The location and science are listed as separate segments separated by dots ('.') and are done so generally with the possibility that this investigation could be used for any dust devil work being done in this location.

Individual Investigation

Individual Investigation products should be used for projects that have a unified scientific goal. Projects of this type will typically have data of a single type or a limited number of types with a singular scientific goal. An example of this type of investigation might be a laboratory study of hydrocarbon chemistry under Titan-analog conditions. In this case there may be different types of observations but they are all part of an investigation led by the same investigator for the purpose of studying Titan hydrocarbon chemistry. The LID could have the form:

urn:nasa:pds:context:investigation:individual.titan_hydrocarbon_chem

Note that any reference to specific programs (e.g., PDART, CDAP, etc.) or investigators is not found in the LID identifier segments. For best practice, it is important to keep those specific values out of LIDs with the goal of reuse of the investigation product for other related studies.

Other Investigation

Other Investigation products typically describe projects that have multiple investigators and/or summarize multiple studies. These may have a unified scientific goal, but the data are not confined to a single instrument or single process. Several incoming projects to PDS involve data restoration and inclusion of published work where original raw data may not be present or materials may be taken from published tables. In these cases it is necessary to submit a context product to describe the project with a focus on the science being captured with the related data. One example of this would be wind-tunnel particle threshold data spanning the history of a specific facility. In this case there are a mixture of wind tunnel experiments run in multiple analog planetary environments, measured over the lifetime of the facility. The resulting data products are a mix of tables of recovered data from both digitization efforts and seminal published papers.

An example of an "Other-Investigation" context product is for a set of wind tunnel experiment results for boundary layer threshold wind speeds across multiple laboratory analog environments using multiple wind tunnels. The LID for this investigation would be something like:

urn:nasa:pds:context:investigation:other.wt_threshold

Again, the investigation identifier is specific to the type of science being investigated, devoid of personal or temporal identifiers. This becomes a general purpose investigation product that can encompass any wind tunnel studies that investigate threshold wind speeds.

Host Context Products

"Host" context products describe an entity that hosts instruments. For missions, this is a straightforward concept – the instrument host is the spacecraft be it a rover, lander, or orbiter. For facilities (observatories and laboratories) the facility is the host. Best practice for both cases is to include the list of member instruments in the host product (a "*host_to_instrument" association*). In many cases this relationship will be bi-directional, meaning that the instrument also lists the facility or instrument that hosts it (a "*instrument_to_host" association)*. Mission context products and mission instruments tend to do this, but facility products can be more complicated.

LID construction follows the form:

urn:nasa:pds:context:<host>:<host_type>.<identifier>

where the <host> can be either *instrument_host* or *facility*, with the <host_type> being either *spacecraft* for instrument host or the choice of *laboratory* or *observatory* for facilities and <identifier> defined to ensure the LID is unique. Note that <identifier> must be unique across all <host_type> as well as telescopes due to the LID formation rules for instruments.

Instrument Host

Instrument Host references a mission host (spacecraft) or some sort of mobile platform as the entity containing the instrument(s). LID construction should follow the following pattern:

urn:nasa:pds:context:instrument_host:<type>.<identifier>

where <type> can be *spacecraft*, *rover*, *lander*, *aircraft, balloons,* and *suborbital rockets* followed by the identifier for the specific instrument host. The <identifier> is defined to ensure the LID is unique.

Here are example LIDs for Hayabusa Spacecraft, Lander, and Rovers:

urn:jaxa:darts:context:instrument_host:spacecraft.hyb2
urn:jaxa:darts:context:instrument_host:spacecraft.dcam3

urn:jaxa:darts:context:instrument_host:lander.mascot

urn:jaxa:darts:context:instrument_host:rover.minerva2-1_hibou
urn:jaxa:darts:context:instrument_host:rover.minerva2-1_owl
urn:jaxa:darts:context:instrument_host:rover.minerva2-2_ulula

Facility

Facility hosts can come in two varieties, either *observatories* or *laboratories*. These are fundamentally different from mobile instrument hosts in that they typically refer to a physical location run by an academic institution as an Earth-based source of data. Facility products should follow the convention:

urn:nasa:pds:context:facility:<type>.<identifier>

where <type> can be ***laboratory*** *or* ***observatory*** and <identifier> defined to ensure the LID is unique

Laboratory

Laboratory host products have essentially the same organizational layout as mission instrument hosts. Best practice should be to include the member instruments as observing systems within the facility product, each with the relationship, *facility_to_instrument*. Inclusion of the member instrument list provides an easy source for narrowing down the list of appropriate instruments for label editing/construction tools.

An example of a laboratory product for the Planetary Aeolian Laboratory at NASA Ames (pal) and the Canadian Light Source synchrotron facility (cls):

urn:nasa:pds:context:facility:laboratory.pal
urn:nasa:pds:context:facility:laboratory.cls

Observatory

Observatory host products will typically have another level of complexity beyond what is used in laboratory or mission instrument host context products. Observatory products should in general list the member telescope(s) (*facility_to_telescope*), with telescopes then listing the appropriate listing of member instruments (*telescope_to_instrument*). Observatories follow the following pattern:

urn:nasa:pds:context:facility:observatory.<identifier>

Observatories are complicated in the way the facility products are designed. (i.e., What constitutes an observatory?) It would be useful to designate the 'observatory' as the building that contains the telescope and instruments. In many cases, an observatory may be comprised of multiple buildings containing multiple telescopes and associated instruments. Locative information about the physical location of the facility should be described within the context product for disambiguation. All telescopes (and telescope observing modes) can and should be listed in the facility products.

Here are example LIDs for the Cerro Tololo Inter-American Observatory (ctio), the Palomar Observatory (palomar), the European Southern Observatory at Paranal (eso-paranal), and NASA's InfraRed Telescope Facility (irtf).

urn:nasa:pds:context:facility:observatory.ctio-cerro_tololo
urn:nasa:pds:context:facility:observatory.palomar
urn:nasa:pds:context:facility:observatory.eso-paranal
urn:nasa:pds:context:facility:observatory.irtf-maunakea

Location and abbreviations together should be used when the observatory has a well-known abbreviation. Otherwise the full name should be used.

There may be non-conforming host product LIDs that have not and will not be migrated forward to fit these guidelines. A list of such non-conforming LIDs is maintained as an appendix to this document. In this case, if new instruments/telescopes need to be added to existing products, the non-compliant LIDs should be propagated forward for internal consistency within the context system for that host, using the previously established abbreviations.

An example of this is the Gemini Observatory (South) at the Summit of Cerro Pachon, Chile:

urn:nasa:pds:context:facility:observatory.gemini-south
urn:nasa:pds:context:telescope:gemini-south.8m1
urn:nasa:pds:context:instrument:gemini-south.8m1.t-recs

A LID in full compliance with these guidelines would have used ‘gemini_south-cerro_pachon’ or something with the location appended as is recommended above, rather than simply ‘gemini_south’. However, since the latter is already established, it will continue to be used. In this system of context products, adding another instrument from Gemini South telescope would be generated using the ‘gemini-south’ segment prefix as it is already established. The pre-existing abbreviation should be used to limit ambiguity for the system of telescope(s)/instrument(s) at a particular site by limiting the possibilities for the LID. All parts of the Gemini South system of context products would then be found together within the PDS4 context system.

Instrument Context Products

Instrument context products describe the data collection devices associated with/connected to appropriate host product(s). As is the case with investigation and host products specificity should progress to the right mirroring the same sort of top-down approach.

Instrument hosts, observatories, and laboratories all have instruments associated with them. For the case of observatories, it is necessary to preserve even more detail including telescope products. For observatory facilities the observatory points (bi-directionally) to the telescope and the telescope points to the associated instrument.

Telescope

Telescope (observatory/portable) products are a special case of instrument products and come in two main varieties. Stand-alone, portable telescopes and fixed telescopes that belong to an observatory. In either case, the telescope context product should have the LID form:

urn:nasa:pds:context:telescope:<host_id*>.<telescope_id>

*In the case of the portable telescopes, the host identifier will be the owner/manager of the telescope. The value <telescope_id> is defined to ensure the LID is unique.

LID formation examples for fixed telescopes include the 4-meter Victor Blanco telescope at CTIO, the 1.88-meter Radcliffe telescope at SAAO, the 200-in Hale telescope at the Palomar observatory, and the 3-meter telescope at IRTF. In these examples, the size and the name of the telescope can be preserved by using the convention of adding the name to the telescope identifier together with the size denoted by using the dimension as the decimal separator (e.g., 1.88-meter becomes 1m88). For consistency, telescope size is converted to meters. Although the LID is formed using meters, the context product also will include dimensions in feet or inches when those have been in common usage, such as for the Palomar 200 inch Hale telescope. The general form for a named telescope is

<telescope>:<observatory id>.<telescope name>_<size>.

For telescopes which are not named the format is

<telescope>:<observatory id>_<size>.

urn:nasa:pds:context:telescope:ctio-cerro_tololo.victorblanco_4m0
urn:nasa:pds:context:telescope:saao-sutherland.radcliffe_1m88
urn:nasa:pds:context:telescope:palomar.hale_5m08
urn:nasa:pds:context:telescope:irtf-maunakea_3m2

urn:nasa:pds:context:facility:observatory.kuiper-airborne
urn:nasa:pds:context:telescope:kuiper-airborne_0m91

For portable telescopes the basic form is the same, however, the host identifier becomes the owner or manager of the portable telescope, where the owner/manager could be a person, group, or institution. In this example, Bruno Sicardy's portable 8-inch telescope would have the LID:

urn:nasa:pds:context:telescope:sicardy_0m2032

Instruments, as listed above, can then be added to telescopes in much the same way as adding to mission spacecraft. The provenance of the instrument is included where possible. Examples of this for fixed telescopes would be the Intermediate dispersion Spectrograph and Imaging System (ISIS) on the William Herschel Telescope (WHT) at the Roque de los Muchachos Observatory (RdlMO) or the Mid-InfraRed Imager and Spectrometer (MIRSI) on the 3-meter telescope at NASA's InfraRed Telescope Facility (IRTF):

urn:nasa:pds:context:instrument:rdlmo.wht.isis
urn:nasa:pds:context:instrument:irtf-maunakea.3m2.mirsi

Groundbased telescope and instrument identifications are often messy and sometimes do not fit in the proposed schemes proposed above. Exceptions are rare and will have to be dealt with on an individual basis. E.g. Las Cumbres Observatory consists of multiple identical telescopes and instruments and resulting data are often delivered without the knowledge which particular telescope in the network was used for a specific datapoint as this is irrelevant.

Note that some comprehensive databases on telescopes (including relevant metadata) seem to exist. One example is the Minor Planet Center. If it turns out that the database is useful for getting metadata from MPC, future telescope context information will be pulled from there (eventually automatically).

Instrument

Instrument (instrument-host/laboratory) context products describe a data collection device necessary for producing the data that are being archived in the PDS. Instruments can be specific to a facility or general purpose for common instruments used by multiple facilities or without a host. In the case of specific instruments these should make use of the bi-directional pointing to show the connection between the host and the instrument; a bi-directional coupling more or less equates to the instrument belonging exclusively to the host. For example, for mission hosts (instrument hosts), bi-directional relationships between the instrument host and the instrument provide the unique combination that the instrument is attached to a spacecraft and can't be transferred to another host. In contrast a general-purpose instrument of a particular make and model may be used in multiple facilities and therefore should not have a bi-directional relationship with the host. In this case, the facility would point to the general instrument.

Instrument context products should have the LID formation as follows:

urn:nasa:pds:context:instrument:<host_identifier>.<identifier>

The full convention also stipulates that the context product file name root parallels the LID. The current implementation is to always use <host_identifier>.<identifier> in the file name, so instruments from the same host appear together in the directory listing.

where <host_identifier> comes from instrument_host, facility, or telescope, and <identifier> is defined to ensure the LID is unique. If the instrument has no host or is a multi-host instrument the <host_identifier> should use 'multi-host' or 'no-host' depending on the case.

Mission examples for instrument products show the host identifier as the instrument host (e.g., spacecraft, rover, lander, etc.) and the instrument identifier. A couple of examples of mission instruments are the Light Detection and Ranging (LIDAR) on the Mars Phoenix (PHX) lander and the Composite InfraRed Spectrometer (CIRS) on the Cassini Orbiter:

urn:nasa:pds:context:instrument:phx.lidar
urn:nasa:pds:context:instrument:co.cirs

Facility instrument LIDs are formed similarly by having the facility identifier as the host portion of the LID along with the instrument identifier. An example of this would be the Mars Surface Wind Tunnel (MARSWIT) at the Planetary Aeolian Laboratory (PAL) located at NASA Ames Research Center:

urn:nasa:pds:context:instrument:pal.marswit

General purpose instruments that are used at more than one facility may not have an associated primary facility and should be listed as '**multi-host**'. Multi-host may describe a single instrument that travels between facilities, or multiple copies of a general purpose instrument (same make/model) that are used at multiple facilities. An example of this would be for the Bruker IFS 125HR Fourier-Transform InfraRed Spectrometer used in multiple synchrotron facilities. This instrument is the same make and model (and therefore the same basic properties) used at two different facilities. The LID for this instrument would be:

urn:nasa:pds:context:instrument:**multi-host**.brukifs125hr_ftspec

An additional variation occurs for some historical instruments for which no distinguishing characteristics are now available. In these cases, include the word "generic" in the instrument ID. An example would be the multitude of InSb high speed photometers produced by different manufacturers and used at observatories around the world in the 1970's and 1980's. The LID for these instruments would be:

urn:nasa:pds:context:instrument:multi-host.generic_insp_hsp

Field instruments or other instruments that are not used in a specific facility may be listed as having no facility by using '**no-host**' for the <host_identifier>. An example would be for the meteorological station developed by Ralph Lorenz for remote observing of dust devils. In this case multiple stations that have the same configuration can be used in a single campaign. The LID for such a detector would be:

urn:nasa:pds:context:instrument:**no-host**.lorenz-met-station

The host facilities that use this instrument could then point to the same general-purpose standard instrument product in their context product listing.

Target Context Products

Target context products describe the object(s) that instruments observe and come in many different types from planetary bodies to calibration targets/fields/stars to dust, plasma, and particle targets, to laboratory analogs and samples, etc. Using target context products in observational data product labels allows the data to be tied to the same target. Whether for planets like Mars or Saturn or small bodies like asteroids or comets the unique identifier allows search and retrieval of products throughout the PDS4 Central Registry to be returned no matter when it was collected. The goal is to allow cross-discipline searches to be aided by target type searches. Disambiguation is always the goal in generating unique product LIDs. In order to do this, target products should have LIDs of the form:

urn:nasa:pds:context:target:<type>.<target_id*>

where <type> is a legal value in the IM.
Currently commonly used values include (V1.13.0.0):

asteroid
astrophysical
calibration_field
calibrator
centaur
comet
dust

dwarf_planet
equipment
laboratory_analog
planet
plasma_stream
satellite
star
trans-neptunian_object

Other, less commonly used, but available values include:
exoplanet_system, galaxy, laboratory_analog, magnetic_field, meteoroid, meteoroid_stream, nebula, planetary_nebula, planetary_system, plasma_cloud, ring, sample, star_cluster

*Systems of targets where more information is useful may have more pieces to the target identifier. The <target_id> can be complicated and should be consistent with the following suggested best-practices:

Asteroids, Centaurs, Dwarf Planets, and Trans-Neptunian Objects

For <target_id> with type = asteroid, centaur, dwarf_planet, or| trans-neptunian_object the following patterns should be used:

<IAUnumber>_<IAUname>	if both have been assigned
<IAUnumber>_<IAUprovisionaldesignation>	if only IAUnumber has been assigned
<IAUprovisionaldesignation>	all other cases

For IAUprovisionaldesignation, replace the internal space with an underscore. If IAU in the future assigns a number or a name to a minor planet, the LID will not change to reflect that. However, if IAU determines in the future that two bodies are actually one, it is unclear how PDS will resolve the LIDs. If IAU previously determined that multiple bodies are actually one, JPL's Solar System Dynamics group, via, http://ssd.jpl.nasa.gov/sbdb.cgi identifies the primary provisional designation.

Examples:
dwarf_planet.1_ceres
dwarf_planet.134340_pluto
dwarf_planet.136108_haumea
asteroid.4_vesta
asteroid.3000_leonardo
asteroid.3708_1974_fv1
asteroid.2018_dv1
centaur.2060_chiron
centaur.10199_chariklo
trans-neptunian_object.15760_albion
trans-neptunian_object.486958_2014_mu69

Comets

For <target_id> with type = comet the following patterns should be used:

<cometNumber>_<IAUname> if cometNumber has been assigned
<cometDesignation>_<IAUname> all other cases

where cometDesignations have the form [PCXDAI]/<yyyy> <letter><digit>, where the initial letter indicates the type of the comet. target_id preserves that letter but drops the following '/'. If the type is P|D|I, IAU may assign the comet a cometNumber. A good way to determine target_id is to use the title returned by the JPL Small-Body Database Browser, accessible from https://ssd.jpl.nasa.gov/sbdb.cgi. If in the future IAU assigns a cometNumber to a comet, the LID will not change to reflect that.

Examples:

comet.c1995_o1_hale-bopp
comet.1p_halley
comet.103p_hartley_2

comet.d1993_f2-g_shoemaker-levy_9
comet.p2004_v3_siding_spring
comet.129p_shoemaker-levy_3
comet.3d_biela
comet.1i_oumuamua

Satellites, Plasma Streams, and Rings

For <target_id> with type = satellite, plasma_stream, or ring the following pattern should be used:

<primaryBody>.<targetNameOrDesignation>

Within targetNameOrDesignation for satellites, drop the slash and any internal spaces if using the provisional designation. For primaryBody, use its target_id, though for the Sun, drop "<primaryBody>." entirely. If in the future IAU assigns a name to a satellite, the LID will not change to reflect that.

Examples:

plasma_stream.solar_wind_1.0
plasma_stream.jupiter.io_torus
ring.saturn.f_ring
satellite.134340_pluto.charon
satellite.136108_haumea.hiiaka
satellite.243_ida.dactyl
satellite.earth.moon
satellite.jupiter.io
satellite.saturn.s2004s13
satellite.neptune.s2004n1
satellite.uranus.ariel

Stars, Planetary Nebulae, and Star Clusters

For <target_id> with type = star, planetary_nebula, or star_cluster use the output of http://simbad.u-strasbg.fr after the "*" in "Basic data". Note that simbad's output string may include '.'.

Examples:

star.sun
star.ksi02_cet
star.pi.02_ori
star.sa_92
star.tet_crt
planetary_nebula.ngc_6543
star_cluster.ngc_104
star_cluster.ngc_3532

Target/name: In order of preference: traditional name, Bayer designation, Flamsteed designation, most ubiquitous of {Draper catalogue number, variable star designation, Gliese catalog number}, other
Identification_Area/Alias_List/Alias/alternate_title: one for each of simbad's "Identifiers" (though those enclosed by [] are papers)
Target/description: right ascension / declination from simbad.

Planets

For <target_id> with type = planet (e.g., mercury, venus, earth, …) the following should be included:

<Target/name>: Mercury, Venus, Earth, …
<Identification_Area/Alias_List/Alias/alternate_title>: "NAIF ID <naifID>"
<Target/description>: the orbital period

Laboratory Analogs and Samples

For <target_id> with type = laboratory_analog, or sample:

Parallels the above target system.

laboratory_analog.saturn.titan
sample.meteorite.nakhla
sample.jsc-1

All Other Types

For <target_id> with all other types:

Examples (with <type>.):

calibration_field.black_sky
calibrator.bias
dust.dust
equipment.apxssite

Guidelines for Context Product Content

Logical Identifiers are only one part of the context product system under the PDS4 Standard. Context products serve as connective metadata for the PDS4 reference system that is used throughout the PDS (and internationally as part of the International Planetary Data Alliance (IPDA)). In order to ensure reliable usage and consistency across PDS, context product content should be considered when using the context system. Certain metadata and references make sense in some instances and less so in others, and it is important to be cognizant of how the context products link together.

Context products are not necessary for end users to see and as such, the content is most important for the PDS4 system to make linkages between products. However, this is not an excuse for not including important and appropriate content. The context system serves as the glue that holds the PDS4 system together and should be treated as important for categorizing your data in the PDS. Appropriately detailed information used in the context system are key to searching and eventual retrieval of data from the PDS.

Across all context products it is important to include several key areas of the label regardless of the type of context products.

Modification History lists the details about the history of the edits of a product. Any time a product is edited once it is in the EN repository, the Modification History will be updated. This section provides dates and descriptions of what has been done to a product. Major and minor changes to a product will be flagged by updating of the version identifier for an individual product; the list of the changes that necessitated the version update will be found in the Modification History.

Reference List can contain various references that preserve linkages to other products or seminal journal papers necessary for connecting all the various pieces of the context system. Products in general should point top-down as is mentioned above. Host products should point to instruments and may point to targets. These links should be referenced here with the LID of the related product and its *reference type*. The *reference type* includes a short phrase of the form: "*x_to_y*", where *x* is the product you are referencing from and *y* is the product you are referencing to. As an example, the instrument host spacecraft *Galileo* had several instruments onboard including the Near-Infrared Mapping Spectrometer (NIMS). The reference in the instrument host product for *Galileo* has a reference to the NIMS instrument with the reference type, "instrument_host_to_instrument."

Seminal published journal papers that describe the system (e.g., spacecraft/instrument papers, facility descriptions, etc.) can also be listed as external references within the Reference List section of the label. Journal references should make use of the DOI field and list the standard reference (author, journal, year) in the description field for the external reference.

Description fields should always be used. Description fields in context products should contain short descriptions that could be displayed as summary information for websites and/or mouse-over text when selecting context products. Context descriptions are not equivalent to PDS3 catalog file listings. Specific information about missions or facilities beyond a short description should be contained in a document and not listed solely within the context product.

Below is discussed other recommended content for specific types of context products.

Investigation Product Content

Investigations should be designed with multiple usage in mind and should be designed with the science case in mind. Care should be placed in naming investigations to allow for the multiple-use science case to be maintained. Guidelines for setup and usage of investigations follows. Investigation products capture the science of the dataset allowing the other products in the system to give the rest of the information about where the science was done, how the data were collected, and for what target(s).

Investigation (Science) -> Host (Where) -> Instrument (How) -> Target (For What)

Missions

Any mission or mission-related project will likely use a mission investigation product. The mission investigation will likely have descriptive information about the mission, its scientific purpose, with linkages to the base components of the spacecraft, and targets observed during the mission. The Reference List will be the dominant part of the label listing out internal references to the spacecraft and targets. Mission investigation context products will likely be set up for missions as they begin their archiving. Past missions that are migrated to PDS4 will likely have their investigations setup before they are migrated.

For example, for the *Hayabusa 2 (Hyb)* mission, the key areas of the label include:

1) Alias List listing alternate identifying titles for the mission if available. (For *Hayabusa 2* the alias is the same as the identifier).
2) Reference List listing component of the spacecraft and the targets (NOTE – Instrument listings do not belong here.)
    a. Lander (urn:jaxa:darts:context:instrument_host:lander.mascot)
       Rovers (urn:jaxa:darts:context:instrument_host:rover.minerva2-1_hibou
       urn:jaxa:darts:context:instrument_host:rover.minerva2-1_owl
       urn:jaxa:darts:context:instrument_host:rover.minerva2-2_ulula)
3) Target Asteroid Ryugu (urn:nasa:pds:context:target:asteroid.162173_ryugu)
4) External References
    i. Mission overview publication (Space Science Review)
5) Investigation description including start/stop dates of operation, and a mission description.

***NOTE:** There is an option to use Logical Identifier Version Identifier (LIDVID) references for context references. For best practices use only LID references. LID references preserve the general relationship information without dependence on a specific version of the context product. When no Version Identifier (VID) is present, the PDS4 system resolves to the latest version of the product. VID referencing should only be used for specific cases where pointing to a specific version of a context product is necessary. This is rarely true. The use of the VID in this case would require multiple products to be updated should the target context product for Mars be updated or enhanced at a later date. The important relationship in this example is that *Mars Pathfinder* went to the planet Mars regardless of the version of the context product for Mars.

Non-mission

Beyond mission related products are observing campaigns, individual investigations, and other investigations. These should be parallel to the mission example but may contain fundamentally different types of information. Any non-mission investigations should be set up prior to the completion of the data submission to PDS as these products will be needed for final validation in harvest and registration into the PDS Central Registry. In most cases these products will need to be completed by the supervising node with input from the data provider. In general, it is best to focus on the science being done for naming these investigations (as shown above), with the goal of reuse. Therefore, it is important not to include names of investigators or specific dates for non-mission investigations. **All non-mission investigation context products need to be submitted by the supporting node ahead of the completion of the data submission.** *(See Submission and Revision section below)*

Observing Campaigns

Observing Campaigns are often long-term or repeated sets of observations with a common target. Observing campaigns need to have references to the resources used for collecting the data. In the case of an observatory (ground-based) observing campaign, the investigation context product should point to the telescope and/or instruments used and the target(s) of the investigation. An example of this type of investigation would be a ground-based observing campaign for Jupiter Support Monitoring using multiple facilities.

urn:nasa:pds:context:investigation:observing_campaign.jupiter_support

Within this investigation, would be infrared observations of Jupiter spanning the 1980s through the present using facilities like NASA's InfraRed Telescope Facility (multiple instruments), European Southern Observatory (Paranal), and the National Observatory of Japan (Hawaii) Subaru telescope. The facilities are located at different locations, but all the observations are for a singular purpose over time. There is a possibility that Jupiter Support Monitoring will continue after the current period, hence the appropriateness of observing campaign as the investigation.

Field Campaigns

Field Campaigns are location-specific studies that are used to compare to planetary settings. Planetary analog studies have long been a part of the process for examining other planetary environments by comparing to readily accessible similar processes on Earth. Together with laboratory experiments and direct observations, field campaigns play an integral role in exploring planetary environments. Field campaigns may also prove useful for testing new technologies to be used for future planetary missions. Context products for field campaign investigations should provide information about the location and the type of science being done to differentiate between investigations. One example of this type of investigation would be collection of dust devil data at the Jornada Experimental Range in New Mexico, to be used for comparison to Mars data. Here we designate the location and the science in the LID:

urn:nasa:pds:context:investigation:field_campaign.jornada_nm.dust_devils

Individual Investigations

Individual Investigations may have varied purposes, including more than one type of data or collection method. Scientific observations that include a specific outcome or set of results would be appropriate for individual investigations. Such investigations should have a unified theme and are typically limited to data products obtained in a similar way for a similar purpose (including all processing and/or calibration steps). An example of this type of investigation could be for a set of laboratory experiments simulating hydrocarbon interactions in the upper atmospheres of the gas giants (Jupiter or Saturn) or Saturn's moon Titan.

urn:nasa:pds:context:investigation:individual.laboratory_hydrocarb_chem

Other Investigations

Other Investigations could be a bit of a catch all for investigations not covered by missions, observing campaigns, or individual investigations. Data restoration projects that include scans of previously non-digital data together with published results and newly collected corroborating data could all be listed under an individual investigation. A data restoration project for the Planetary Aeolian Laboratory (PAL) at NASA Ames would have recently scanned, unpublished original data (on hardcopy plots only), together with published data tables for other data, alongside recently collected digital data for varying planetary analog environments examining wind tunnel particle threshold data. This would be an example of something that is neither an observing campaign nor an individual investigation, but something that spans multiple investigations over time for multiple target environments.

urn:nasa:pds:context:investigation:other.wt_threshold_speed

In this case the identifier of the investigation describes planetary wind tunnel work and specifically particle threshold wind speed data, suggesting that this investigation could be used by other data providers if they intend to submit more wind tunnel threshold data in the future.

Host Product Content

Host products come in two main types, as discussed above: *instrument host*, and *facility*. Host products tend to describe where the data were collected. Were the data collected from a spacecraft? Were they collected in a laboratory, or from an observatory? All metadata associated with the host product should focus on giving specifics about where the host was located as well as which instruments were attached to it.

Investigation (Science) --> <u>Host (Where)</u> --> Instrument (How) --> Target (For What)

Remember, *instrument hosts* are predominantly used for missions where instruments are attached to a spacecraft. *Facilities* come in two main varieties (*Observatories* and *Laboratories*) and refer to locations that house instruments used for specific types of scientific observations. Recommended content for each of these depends on the type of product.

Instrument Hosts

Spacecraft (including Rovers and Landers) are typically single-use mission-related hosts that include instruments that are attached and typically used only for that mission. As such, it is important to show that relationship by including the list of attached instruments. The host context product may also reference back to the mission investigation product for completeness. Mission products (investigation and instrument host) represent a specific limited case for context products. They are limited because spacecraft are rarely reclaimed and reused, which means that the mission context system typically sets up a unique set of pairings. If referenced correctly, the context system will allow seamless referencing allowing clean search and retrieval of data products under the PDS4 standard.

Facilities

Facility products typically describe the instrument hosts of non-mission-type data and are most often associated (not exclusively) with Earth-based facilities. The most common of these are Laboratories and Observatories. In both cases the facility tends to be a physical location with a building or set of buildings that house the instrument(s) and/or telescope(s) used in whatever study is being conducted. Information critical to search and retrieval processes relates to the location of these facilities, instrumentation belonging to the facility, and the type(s) of science done at that facility. Guidelines for the types of facility-specific information follow.

Laboratories

Laboratories should contain descriptive information about the location of the facility, including the parent institution. The Reference List should contain a list of commonly used instruments at that facility. The instrument list may be unique instruments available only at that facility (bi-directional pointing) or general purpose instruments that move from lab to lab. External References could be added to reference specific seminal publications important to the operation and function of the facility.

General Purpose Instruments

Australian Synchrotron Facility --> Bruker IFS 125HR Fourier Transform Spectrometer
Canadian Light Source Facility --> Bruker IFS 125HR Fourier Transform Spectrometer

The same make and model of spectrometer is being used by two different facilities, hence a single instrument product with a unidirectional pointer from the facility.

Unique Instrument Pairings

Planetary Aeolian Laboratory (PAL)   Mars Surface Wind Tunnel (MARSWIT)
Mars Simulation Laboratory (Aarhus)   Aarhus Wind Tunnel AWSTII 2010

In both cases the wind tunnels are unique to that facility and can be expressed with bi-directional pointers to show this pairing.

Observatories

Observatories should reference the structure(s) that house their respective telescopes and instruments. Therefore, the logical unit for most observatories will be the building(s) that surround the instruments. Because observatories can be complex constructs, it is important to name these consistently as possible. For example, the European Southern Observatory at Paranal, Chile, consists of 4 main telescopes, but has 5 main observing modes: each telescope individually and an interferometer mode where the 4 telescopes are used in unison.

Other observatories may fall into a system of facilities. One example would be Mauna Kea Observatories (MKO), an organization which encompasses a large number of facilities. For the purpose of PDS4 referencing, location information for observatories is important for search and retrieval, allowing users to search by a particular peak or specific location. However, because of the large number of individual facilities associated with this location, it is preferred to tie the scientific observations (collected data) to the individual facility and telescope. MKO refers to too many individual observatories to be useful for search. For example, the NASA Infrared Telescope Facility (IRTF) or the National Astronomical Observatory of Japan (NAOJ) – Subaru, are two observatories located on the peak of Mauna Kea in Hawaii but each contain their own telescopes and instruments managed by different entities. Each of these facilities should be treated as their own host context products. In these examples, important information to include in the facility:observatory products is the official name of the facility, aliases for other common names of the facility, and location and management information can be added to the description associated with the product. The Reference List should contain a list of all telescopes associated with the facility as internal references. ** NOTE: Telescope instruments should be referenced by the telescope product not the observatory. External references may contain seminal published paper references or potentially the facility website homepages for further information about the facility.

Instrument Product Content

Instrument context products provide information and linkages to 'how' the science is accomplished in the PDS4 context product system. Instruments are the base product for collecting data and usually belong to or are used by a host. As stated above, the host can be a spacecraft, a laboratory, or an observatory where the instrument is hosted. Instruments could be spectrometers, cameras, wind sensors, magnetometers, etc. and are tied to what they are observing through the target products.

Investigation (Science) --> Host (Where) --> <u>Instrument (How)</u> --> Target (For What)

Instrument products should contain information about how the instrument works. The 'Instrument' section of the label has tags for the name and type of the instrument allowing a coarse assessment of the type of science done by this instrument. Model and serial numbers may be present and the description field at the end of the label should give information about specific wavelength ranges, data output restrictions, manufacturer information, and/or how it might relate to the host and/or targets. The concept behind adding this type of information is to uniquely identify this instrument for this purpose. For purely unique cases, the Reference List will point back to the host product through internal references. For general purpose cases there will not be a reference back to the host, due to the possibility of multiple hosts or non-unique relationships. External references should be used to designate published work that describes the instrument. This could be seminal journal papers, publicly available user manuals, or manufacturer/academic websites that describe the instrument.

As of IM V1.13.0.0 (1D00), instrument types are handled by the Context Type List Instrument (CTLI) dictionary. As a result, all instrument products should contain the necessary references to that dictionary, as well as the appropriate corresponding IM Version. Both references should be listed in the preamble of the instrument context product. Currently version 1.0 of the CTLI dictionary is concurrent with IM V1.13.0.0 (1D00). Using the CTLI dictionary changes the way instrument types are denoted within the context product. Namely within <Instrument> a new section must be added, <Type_List_Area>. This new section contains a <ctli:Type_List> composed of only the <ctli:Type> class, which makes use of a separately maintained enumerated value list for the instrument type designations. By moving to an externally managed dictionary for the instrument type enumerated list, newer values can be updated more frequently, and more efficiently. The enumerated list in the .sch file (https://pds.nasa.gov/datastandards/dictionaries/ctli/v1/PDS4_CTLI_1D00_1000.sch) will contain the current set of acceptable values. Node representatives can be contacted to add new values if needed.

Telescopes are special cases of instrument products. To facilities, telescopes are essentially instruments that also happen to be instrument hosts. Telescope products should contain positional information such as longitude, latitude, and elevation. Name alias information should be included where appropriate if there are other common names for the telescope. The description field may contain information about the capabilities of the telescope or potentially historical information that may be pertinent to the operation of the telescope. The Reference List section should be used to point back to the observatory as well as list any instruments that are used with the telescope. If the telescope is portable (non-facility) instruments may be the only internal references. External references could also be used as above for seminal published papers, user guides, and/or website information.

If the telescope product requires an instrument type component, the addition of the Context Type List Instrument dictionary may be necessary (see above *Instrument* instructions). The use of the CTLI dictionary will only be valid for IM V1.13.0.0 and above products and should reference the appropriate version of the dictionary.

Target Product Content

Targets are used as the identifiers for the purpose of the science – which targets are the subject for the science investigation? Under the PDS4 standard, target references are required for observational products. The most common targets will be planetary bodies (e.g., planets, satellites, asteroids, comets, etc.). Calibration targets will be common for missions and ground-based observing campaigns. In non-mission investigations laboratory analog and/or sample targets are necessary to differentiate non-planetary-body targets for search and retrieval.

Investigation (Science) --> Host (Where) --> Instrument (How) --> <u>Target (For What)</u>

Important content for targets includes the IAU designation/name of the body plus whatever alternative designations there may be for that target. Alternative designations should be listed in an Alias List (before the Modification History), one alias for each designation. Target descriptions for planetary bodies may contain information about the target body like its orbital period, or size information, links to geometric shape files, etc. The purpose is to uniquely identify targets that will be tied to science observations to aid with tying observations together from dataset to dataset. Laboratory studies do the same thing, by pointing to the analog target for the laboratory version of the target. This laboratory version may be a laboratory analog environment or a collected sample of a target or in some cases a synthetic sample meant to simulate a parent body. Laboratory Analog targets point to a simulated environment for the target body and are used for experiments conducted under approximate planetary conditions. Meteorites are by definition samples of planetary bodies (planets, comets, asteroids, etc.) from which the parent body may or may not be identifiable.

When using target products, most of the planetary bodies should exist and node personnel can point providers to the proper forms (considering differences in names of targets) or provide tools for navigating the PDS EN context repository. In cases of non-mission, laboratory analogs and samples, the need may occur where a suitable target does not already exist in the repository. If this happens, data providers will need to work with their node representative to submit a new product to the EN. (*See next section*)

Submission of New Context Products and Revision of Current Products

Context products that are needed and currently are not found in the EN Context Bundle (https://pds.nasa.gov/data/pds4/context-pds4/) will need to be submitted and added to the EN context bundle prior to final harvest and registration of the bundles that use them. Typically, as discussed above, new missions are submitted as the missions start to archive including the investigation, host product(s), and instruments. For non-mission data projects, there may be a need to submit new facility, telescope/instrument, and target products with new investigations describing the science.

Following the guidelines outline above, node representatives should submit new context products through Richard Chen at the EN. Richard will validate and register the new products through the Context Bundle and host the products online through the website at JPL. New products will be added to collection inventories at that time before the registration.

Additional instruments, augmentations to existing context products, and/or fixes to the internal/external references for existing context products (etc.) should be handled in the same way. Edited products are submitted to Richard Chen at the EN for review, upon acceptance collection inventories are updated with revised LIDVIDs and the new products can be harvested and registered. These are then usable via the JPL website referenced above.

File naming conventions should be simple forms of the LIDs. The suggested scheme is to use the file portion of the LID as the file name for the repository. Some examples of this are as follows:

urn:nasa:pds:context:instrument_host:spacecraft.insight	spacecraft.insight.xml
urn:nasa:pds:context:instrument:insight.rise	insight.rise.xml
urn:nasa:pds:context:telescope:ctio.blanco4m0	ctio.blanco4m0.xml

Within the EN Context Bundle, each context type is its own collection, so instruments are grouped with instruments, instrument hosts are grouped with instrument hosts, facilities with facilities and so on. Whether inputting context references by hand or by software/scripting options, it is important to remember the context products are grouped by type.

Appendix A

Non-conforming, Grandfathered LIDs (to be rechecked after fixes)

urn:nasa:pds:context:instrument:telescope.birc.sto
urn:nasa:pds:context:instrument:telescope.spex.irtf3m0

urn:nasa:pds:context:instrument:<instrument_id>.<spacecraft_id>:

urn:nasa:pds:context:instrument:sws.a12a	
urn:nasa:pds:context:instrument:ccig.a14a	
urn:nasa:pds:context:instrument:*.a15a	3 LIDs
urn:nasa:pds:context:instrument:*.a15c	3 LIDs
urn:nasa:pds:context:instrument:lsrp.a15l	
urn:nasa:pds:context:instrument:lsm.a16a	
urn:nasa:pds:context:instrument:*.a16c	3 LIDs
urn:nasa:pds:context:instrument:lsrp.a16l	
urn:nasa:pds:context:instrument:*.a17a	4 LIDs
urn:nasa:pds:context:instrument:*.a17c	3 LIDs
urn:nasa:pds:context:instrument:tg.a17l	
urn:nasa:pds:context:instrument:*.ch1-orb	2 LIDs
urn:nasa:pds:context:instrument:*.clem1	8 LIDs
urn:nasa:pds:context:instrument:*.co	14 LIDs
urn:nasa:pds:context:instrument:*.con	5 LIDs
urn:nasa:pds:context:instrument:*.dawn	4 LIDs
urn:nasa:pds:context:instrument:*.dif	4 LIDs
urn:nasa:pds:context:instrument:its.dii	
urn:nasa:pds:context:instrument:*.ds1	3 LIDs
urn:nasa:pds:context:instrument:*.gio	9 LIDs
urn:nasa:pds:context:instrument:*.go	12 LIDs
urn:nasa:pds:context:instrument:*.gp	8 LIDs
urn:nasa:pds:context:instrument:lgrs-a.grail-a	
urn:nasa:pds:context:instrument:lgrs-b.grail-b	
urn:nasa:pds:context:instrument:*.hay	3 LIDs
urn:nasa:pds:context:instrument:*.hp	7 LIDs
urn:nasa:pds:context:instrument:*.hst	2 LIDs
urn:nasa:pds:context:instrument:*.ice	7 LIDs
urn:nasa:pds:context:instrument:*.insight	4 LIDs
urn:nasa:pds:context:instrument:fpa.iras	
urn:nasa:pds:context:instrument:*.iue	3 LIDs
urn:nasa:pds:context:instrument:*.jno	3 LIDs
urn:nasa:pds:context:instrument:*.lcross9 LIDs	
urn:nasa:pds:context:instrument:*.lp	8 LIDs
urn:nasa:pds:context:instrument:*.lro	8 LIDs
urn:nasa:pds:context:instrument:*.m10	2 LIDs
urn:nasa:pds:context:instrument:*.maven	10 LIDs
urn:nasa:pds:context:instrument:*.mer1	11 LIDs
urn:nasa:pds:context:instrument:*.mer2	11 LIDs
urn:nasa:pds:context:instrument:*.mess	14 LIDs
urn:nasa:pds:context:instrument:*.mex	7 LIDs
urn:nasa:pds:context:instrument:*.mgn	2 LIDs
urn:nasa:pds:context:instrument:*.mgs	7 LIDs

urn:nasa:pds:context:instrument:rss.mo	
urn:nasa:pds:context:instrument:*.mpfl	4 LIDs
urn:nasa:pds:context:instrument:*.mpfr	4 LIDs
urn:nasa:pds:context:instrument:*.mr6	3 LIDs
urn:nasa:pds:context:instrument:*.mr7	3 LIDs
urn:nasa:pds:context:instrument:*.mr9	2 LIDs
urn:nasa:pds:context:instrument:*.mro	8 LIDs
urn:nasa:pds:context:instrument:*.msl	27 LIDs
urn:nasa:pds:context:instrument:spirit3.msx	
urn:nasa:pds:context:instrument:rebelxt.n-a	
urn:nasa:pds:context:instrument:*.near	7 LIDs
urn:nasa:pds:context:instrument:*.nh	7 LIDs
urn:nasa:pds:context:instrument:*.ody	5 LIDs
urn:nasa:pds:context:instrument:*.p10	7 LIDs
urn:nasa:pds:context:instrument:*.p11	9 LIDs
urn:nasa:pds:context:instrument:*.p12	2 LIDs
urn:nasa:pds:context:instrument:*.phb2	3 LIDs
urn:nasa:pds:context:instrument:*.phx	13 LIDs
urn:nasa:pds:context:instrument:cdd.pioneer_8	
urn:nasa:pds:context:instrument:cdd.pioneer_9	
urn:nasa:pds:context:instrument:*.pvo	9 LIDs
urn:nasa:pds:context:instrument:*.ro	15 LIDs
urn:nasa:pds:context:instrument:*.sakig	2 LIDs
urn:nasa:pds:context:instrument:*.sdu	5 LIDs
urn:nasa:pds:context:instrument:lasco.soho	
urn:nasa:pds:context:instrument:esp.suisei	
urn:nasa:pds:context:instrument:*.uly	18 LIDs
urn:nasa:pds:context:instrument:roe.v15	
urn:nasa:pds:context:instrument:roe.v16	
urn:nasa:pds:context:instrument:*.vega1	9 LIDs
urn:nasa:pds:context:instrument:*.vega2	7 LIDs
urn:nasa:pds:context:instrument:rss.vex	
urn:nasa:pds:context:instrument:*.vg1	11 LIDs
urn:nasa:pds:context:instrument:*.vg2	14 LIDs
urn:nasa:pds:context:instrument:*.vl1	5 LIDs
urn:nasa:pds:context:instrument:*.vl2	5 LIDs
urn:nasa:pds:context:instrument:*.vo1	4 LIDs
urn:nasa:pds:context:instrument:*.vo2	4 LIDs

urn:nasa:pds:context:investigation:individual.none