PDS4 Survey Local Data Dictionary Users' Guide

Small Bodies Node

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1 Introduction

The Survey discipline dictionary was originally created by the PDS Small Bodies Node in support of groundbased sky survey data such as NEAT, CSS, Spacewatch, and LONEOS.

1.1 Purpose of this Users' Guide

The users' guide is intended to provide help in using the Survey discipline dictionary to include metadata specific to survey data in PDS4 Product_Observational labels.

1.2 Audience

This user's guide is for any data provider who submits survey data to the PDS. Familiarity with basic PDS4 concepts is helpful.

1.3 Applicable Documents

PDS4 Standards Reference: https://pds.jpl.nasa.gov/datastandards/documents/sr/
PDS4 Information Model: https://pds.nasa.gov/datastandards/documents/im/

2 Overview of the Survey Discipline Data Dictionary

Survey is intended to provide classes and attributes for metadata specific to survey data. This includes metadata relating to the position of the observation and the sky conditions. The Small Bodies Node holds the stewardship of Survey, with Jesse Stone (jstone@psi.edu) as the current point of contact.

Section 3 of this Guide covers how to include the classes and attributes of the dictionary in a PDS label file. Section 4 goes into more detail on the structure of the classes and attributes and how they are intended to be used. See section 5 for detailed specifications of each class and attribute.

3 How to Include the Survey Dictionary in a PDS4 Label

3.1 Data Dictionary Files

PDS4 dictionaries appear in several forms, typically having the same filename with different extensions. It can either be an ingest file, or a schema file coupled with a schematron file. The ingest file, with xml extension, is used for authoring the dictionary and often for ingesting it into tools, while the schema (.xsd) and schematron (.sch) files, which are compiled from the ingest file, are used to actually validate a product label. For released dictionaries, all these can be obtained from the PDS4 released schema page at https://pds.jpl.nasa.gov/datastandards/schema/released/and from GitHub at https://github.com/pds-data-dictionaries/ldd-survey.

3.2 Including the schema file in a label

In order to use the schema file, the Product_Observational element of your product label will need to have references to the dictionary added to it, as follows (for IM 1.22.0.0):

```
<Product_Observational
xmlns="http://pds.nasa.gov/pds4/pds/v1"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:survey="http://pds.nasa.gov/pds4/survey/"
xsi:schemaLocation="http://pds.nasa.gov/pds4/pds/v1
https://pds.nasa.gov/pds4/pds/v1/PDS4_PDS_1M00.xsd
http://pds.nasa.gov/pds4/survey/v1
https://pds.nasa.gov/pds4/survey/v1/PDS4_SURVEY_1M00_1100.xsd">
```

This example assumes that the survey is the only dictionary in your label. If you have multiple dictionaries, you will need to make other modifications. Generally, you will need to integrate the bolded parts above into your label.

3.3 Including the schematron in a label

In order to use the schematron file, the xml prolog of your product label will need to have references to the dictionary added to it, as follows:

```
<?xml-model
href="https://pds.nasa.gov/pds4/survey/v1/
PDS4_SURVEY_1M00_1100.sch"
schematypens="http://purl.oclc.org/dsdl/schematron"?>
```

3.4 Including the data dictionary elements

The data dictionary defines XML elements that can be used in a Discipline_Area. A minimal example of the discipline area follows. A more detailed example for each class is given in the later sections of this Guide.

```
<Discipline_Area>
  <survey:Survey>
    <survey:observation_purpose>Survey<survey:observation_purpose>
  </survey:Survey>
</Discipline_Area>
```

4 Organization of Classes and Attributes

The overall organization of classes and attributes for all of Survey is shown in Figure 1. The dictionary contains three major classes, some with subclasses: Image_Corners, Limiting_Magnitudes and Rollover.
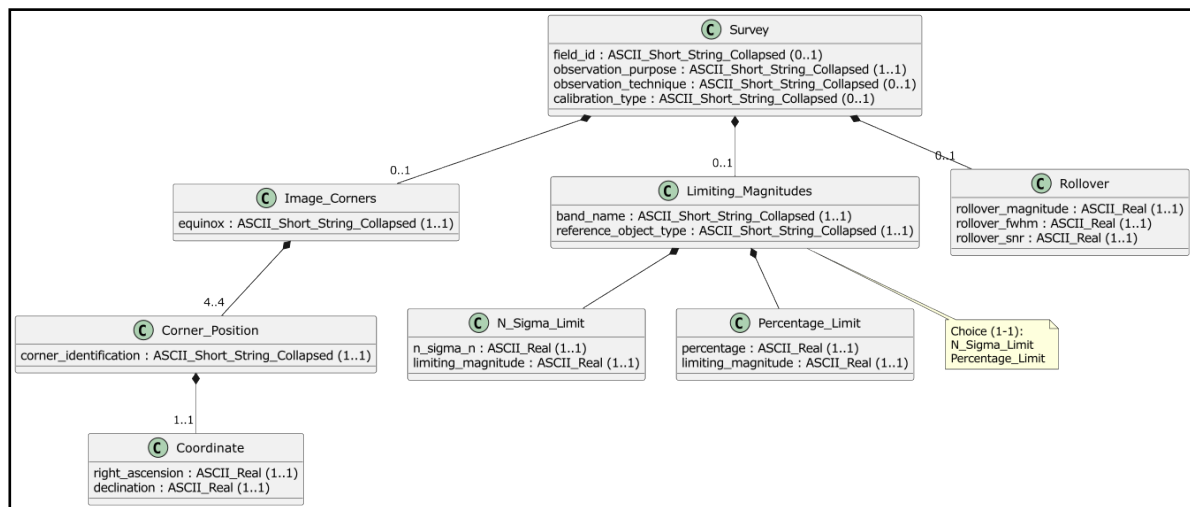

Figure 1: Organization of classes and attributes in the Survey dictionary

4.1 The Image Corners Class

Specifies the image corners (position and coordinates) for every of the four corners. It is mandatory for non-calibration images.

This class currently includes the corner position class (e.g. Top Left), and Coordinate Class.(right ascension and declination). It has a mandatory attribute of equinox.

The corner location refers to the location according to the display direction. E.g., an image displayed with N on the top and E to the left will have different (RA,Dec) values for the Top Left corner than the same image with display directions e.g. North at the bottom and E to the right.

Here is an example of how this class may be included in a label:

```
<survey:Image_Corners>
    <survey:equinox>J2000.0</survey:equinox>
    <survey:Corner_Position>
        <survey:corner_identification>Top Left
        </survey:corner_identification>
        <survey:Coordinate>
            <survey:right_ascension unit="deg">182.420830
            </survey:right_ascension>
            <survey:declination unit="deg">10.100340</
survey:declination>
        </survey:Coordinate>
    </survey:Corner_Position>
    <survey:Corner_Position>
        <survey:corner_identification>Top Right</</
survey:Coordinate>
         … and analogous for Bottom Left and Bottom Right
        </survey:Corner_Position>
</survey:Image_Corners>
```

4.2 The Limiting Magnitudes Class

The optional Limiting Magnitude Class gives a measure of the limiting magnitude of the survey image specifying the band or filter used and the reference object type (e.g. asteroid). The limiting magnitude can be either expressed as a magnitude and the percentage of known objects (e.g. asteroids) detected at that magnitude, or as a magnitude and significance of n-sigma (i.e. a S/N of n) of a point source.

For example:

```
<survey:Limiting_Magnitudes>
    <survey:band_name>G</survey:band_name>
    <survey:reference_object_type>Asteroid
    </survey:reference_object_type>
    <survey:Percentage_Limit>
        <survey:percentage>50</survey:percentage>
        <survey:limiting_magnitude>18.86</
survey:limiting_magnitude>
    </survey:Percentage_Limit>
    <survey:Percentage_Limit>
        <survey:percentage>0</survey:percentage>
        <survey:limiting_magnitude>20.11</
survey:limiting_magnitude>
    </survey:Percentage_Limit>
</survey:Limiting_Magnitudes>
```

4.3 The Rollover Magnitude Class

Gives the properties of the peak of the histogram of stellar magnitudes within the image specifying the corresponding FWHM and SNR.

```
<survey:Rollover>
    <survey:rollover_magnitude>21.60</survey:rollover_magnitude>
    <survey:rollover_fwhm unit="arcsec">3.60</
survey:rollover_fwhm>
    <survey:rollover_snr>3.56</survey:rollover_snr>
</survey:Rollover>
```

5 Definitions

5.1 Classes (alphabetical order)

Coordinate — class

The coordinates of the corners of the image

Member of: Corner_Position

Cardinality: Single, Required

Members:

- declination
- right_ascension

Corner_Position — class

The position of the corners in the image

Member of: Image_Corners

Cardinality: Single, Required

Members:

- corner_identification
- Coordinate

Image_Corners — class

Specifies the image corners

Member of: Survey

Cardinality: Quadruple, Situational (Optional for calibration images)

Members:

- equinox
- Corner_Position

Rules:

- If "Image_Corners" is specified and the product contains an image "Display_Settings" must be specified, as well.

Limiting_Magnitudes — class

Gives the limiting magnitude of the image.

Member of: Survey

Cardinality: Choice (N_Sigma_Limit, Percentage Limit), Optional

Members:

- band_name
- reference_object_type
- N_Sigma_Limit
- Percentage_Limit

N_Sigma_Limit — class

The limiting magnitude of a point source at a significance of n-sigma.

Member of: Limiting_Magnitudes

Cardinality: Single, Optional

Members:

- n_sigma
- limiting_magnitude

Percentage_Limit — class

The limiting magnitude of the image, expressed as a magnitude, and the percentage of known objects detected at that magnitude.

Member of: Limiting_Magnitudes

Cardinality: Single, Optional

Members:

- percentage
- limiting_magnitude

Rollover — class

Gives the properties of the peak of the histogram of stellar magnitudes.

Member of: Survey

Cardinality: Single, Optional

Members:

- rollover_magnitude
- rollover_fwhm
- rollover_snr

Survey — class

This class specifies the parameters for survey images. magnitudes.

Member of: Discipline_Area

Cardinality: Single, Required

Members:

- Image_Corners
- Limiting_Magnitudes
- Rollover
- field_id
- observation_purpose
- observation_technique
- calibration_type

5.2 Attributes (alphabetical order)

band_name — attribute

Specifies the band or filter for the limiting magnitude

Member of: Limiting_Magnitude

Cardinality: Single, Required

Data Type: String

calibration_type — attribute

Specifies the type of calibration image.

Member of: Survey

Cardinality: Single, Optional

Data Type: String

Rules:

- must be one of the following values: 'Bias', 'Dark', 'Flat Field', 'Fringe Correction'.

corner_identification — attribute

Identifies the corner in the image.

Member of: Corner_Position

Cardinality: Single, Required

Data Type: String

Rules:

- must be one of the following values: 'Bottom Left', 'Bottom Right', 'Top Left', 'Top Right'

declination — attribute

Specifies the declination of the coordinate.

Member of: Coordinate

Cardinality: Single, Required.

Data Type: Real

Rules:

- the unit must be one of the following values: 'arcmin', arcsec', 'deg', 'hr', 'mirrored', 'mrad', 'rad'.

equinox — attribute

Specifies the equinox of the coordinates

Member of: Image_Corners

Cardinality: Single, Required

Data Type: String

field_id — attribute

Specifies the internal id of the observation in the survey.

Member of: Survey

Cardinality: Single, Optional

Data Type: String

limiting_magnitude — attribute

Specifies the limiting magnitude of a point source with a S/N of n for N_Sigma_Limit or of the image and the percentage of known objects detected at that magnitude for Percentage_Limit

Member of: N_Sigma_Limit or Percentage_Limit

Cardinality: Single, Required

Data Type: Real

n_sigma_n — attribute

Specifies the value of n for n-sigma limiting magnitude.

Member of: N_Sigma_Limit

Cardinality: Single, Required

Data Type: Real

observation_purpose — attribute

Specifies the purpose of the observation.

Member of: Survey

Cardinality: Single, Required

Data Type: String

Rules:

- must be one of the following values: 'Calibration', Followup', 'Survey'.

- the 'Calibration' observation_purpose may only be used for calibration images.

- if the observation_purpose is not 'Calibration', image corners must be specified.

observation_technique — attribute

Specifies the technique used for the observation.

Member of: Survey

Cardinality: Single, Optional

Data Type: String

Rules:

- must be one of the following values: 'Non-Sidereal Drift Scan', 'Non-Sidereal Stare', 'Sidereal Drift Scan', Sidereal Stare', 'Track-And-Stack'.

percentage — attribute

Specifies the percentage of known objects detected at the limiting magnitude.

Member of: Percentage_Limit

Cardinality: Single, Required

Data Type: Real

reference_object_type — attribute

Specifies the type of observed object used to calculate the limiting magnitude

Member of: Limiting Magnitude

Cardinality: Single, Required

Data Type: String

Rules:

- the unit must be one of the following values: 'Asteroid', "Comet", 'Galaxy', 'Star'.

right_ascension — attribute

Specifies the right_ascension of the coordinate.

Member of: Coordinate

Cardinality: Single, Required.

Data Type: Real

Rules:

- the unit must be one of the following values: 'arcmin', arcsec', 'deg', 'hr', 'mirrored', 'mrad', 'rad'.

rollover_fwhm — attribute

Specifies the full width at half maximum of stellar sources at the magnitude of the peak of the histogram of stellar magnitudes in the image, in arcseconds.

Member of: Rollover

Cardinality: Single, Required.

Data Type: Real

rollover_magnitude — attribute

Specifies the magnitude of the peak of the histogram of stellar magnitudes in the image.

Member of: Rollover

Cardinality: Single, Required.

Data Type: Real

rollover_snr — attribute

Specifies the signal-to-noise ratio (SNR) at the magnitude of the peak of the histogram of stellar magnitudes in the image..

Member of: Rollover

Cardinality: Single, Required.

Data Type: Real