NH-P/PSA-LEISA/MVIC-5-COMP-V1.0

**CRITICAL LIENS**

* aareadme.txt
	+ Line 107: “description” misspelled
* dataset.cat
	+ Line 49: “mosaicked” misspelled
	+ Spell out “MET” and “CCD” for first occurrence in file
	+ Line 293: “cube fits files” should be “cube FITS files”
	+ Line 275: “SPICE” is an acronym and must be capitalized; should be spelled out for first occurrence.
	+ Line 415: “one spectel” is either a misspelling or jargon that must be defined
* dataset\_projection.cat
	+ The conversion from Lat/Lon to Line/Sample appears to be incorrect. Reviewer T. Hare noted:

The LOLA team uses the same projection and have a really good section with example. This whole part can probably be taken from: <http://pds-geosciences.wustl.edu/lro/lro-l-lola-3-rdr-v1/lrolol_1xxx/catalog/dsmap.cat>

Also the values the LOLA team have calculated have been checked and rechecked by several people (because there was/is a problem with the MOLA archive).

* absorp/ files
	+ Add an IMAGE\_MAP\_PROJECTION object to the data labels with the appropriate geometry. [Note from A.Raugh: Trent Hare, thare@usgs.gov, has offered to advise.]
	+ Images and the geometry file should be in the same storage order and display orientation.
	+ Labels must contain all required metadata, some of which might be “N/A”. Applicable supplementary metadata (like MISSING\_CONSTANT, units of measure, references to source products, etc.), also needs to be added.
	+ Some pixels appear to contain a missing value indicator, but none is defined. See Figure 1 on page 4 of Trent Hare’s review notes:

<https://pdssbn.astro.umd.edu/review/201805_comet/presentations/NewHorizon_PDS3_Review_Hare_v2_liens.docx>

* color/ files
	+ Strongly recommend that the QUBE files be relabeled as banded images, as is done in the mosaic/ directory, complete with filter names and band dimensions. Note that the current core saturation constants need to be converted to appropriate MISSING\_CONSTANT, NULL\_CONSTANT, etc., keywords if they actually occur in the data.

If the QUBE object is retained in the labels, CORE\_VALID\_MINIMUM must be replaced with a valid value (the current value is NaN), and band information still needs to be added. If invalid (i.e., NaN) values exist in the data file, they must be replaced with representable floating point values corresponding to a defined CORE\_\* constant keyword. Note that, in general, CORE\_\* keywords are not allowed to be set to “N/A”, “UNK”, or “NULL”.

[Note from Anne Raugh: There’s a handy decimal-to-binary hardware representation converter you can use to check both IEEE floating point and integer conversions here:

 <http://www.binaryconvert.com/>

Been usin’ it a *lot* lately.]

* mosaic/ files
	+ File cpmap\_cyl\_k3201.img is shifted 180 degrees within its Cartesian plane because of an incorrect SAMPLE\_PROJECTION\_OFFSET value. Correct value to “1903.5 <pixel>”.
	+ File pmap\_cyl\_k3201.img has an extra 10 degrees in longitude that should be clipped.

**ADDITIONAL LIENS**

* aareadme.txt
	+ Line 33: “in this dataset that include” should be “in this dataset, which include” (non-restrictive clause).
	+ Line 60: There is a reference to a non-existent “document/” directory that at the least needs to be removed. If this is boilerplate, then all the text needs to be reviewed for applicability to the present data set.
	+ Line 61-63: Please include the data set ID reference for the documentation data set. [AR: If this DSID is not settled on, yet, let’s settle on it and at least get a place-holder dataset.cat file into the PDS3 catalog database.]
	+ Line 107: “description” is misspelled.
* catinfo.txt
	+ Line 15: The word “Composition” is in the wrong place. Please also consistently use capitalization and phrasing if the intention is to echo the title of the data set “Pluto Encounter Composition Maps” here and in line 7.
* dataset.cat
	+ [AR: This data set has no document/ directory, but some of the explanations requested below may be sufficiently complex that a separate document should be created, or the information extracted from the dataset.cat DESCRIPTION into one or more documents. These documents can then be referenced, of course.]
	+ The level and nature of potential artifacts in the absorp/ data is not sufficiently explained. Karl Hibbitts notes:

For instance, LVF’s have a spectral/spatial registration issue because of the physical curvature of the filter regions; this has been removed to the best of the ability of the team, but it’s not clear if spectral/spatial artifacts in the band depth maps persist.

* + Need a specification of exactly which bands were used to generate the band depth map, and the exact methodology (e.g., an equation) used to derive a band depth.
	+ Please clarify whether the BD map were created first and then mosaicked. Include a note to users that features that are linear in the original projection may be artifacts.
	+ If errors and uncertainties are not provided in individual labels, please include an overall assessment/description of these in the CONFIDENCE\_LEVEL\_NOTE text of this file.
	+ Provide a reference for the FITS standard used to format the data. A ref.cat entry should be created for this as well. [Note from AR: There is not a REFERENCE object for any FITS standard in the PDS3 archive now.]
	+ Spell out the first instance of the ISIS acronym (the second is in this case). Use “ISIS3” to reference the software, rather than “ISIS” (unless some other version of the ISIS software was used).
	+ If there is an official reference to the ISIS3 software, please include it in the text and ref.cat file.
	+ The floating point value “-3.4028235e-38” is described in this file as a “bad pixel flag” for the spec/ directory data, but this value cannot be exactly represented in floating point, and the actual data file appears to use a different fill value for bad pixels. This discrepancy must be resolved here and in the data labels. [AR: A number approximately equal to -3.4028235e+38 is the smallest (i.e., most negative) number that can be represented in an IEEE 4-byte real number. The MSB bit pattern for the actual minimum value is represented in PDS3 as “16#FF7FFFFF”. The exact floating point representation has more than 30 digits following the decimal point.]
	+ Please include an explanation of the color/ directory file naming conventions for the files that contain MET.
	+ The existence and effect of the glue bond gap in the Spec/ data should be mentioned.
	+ Line 106: claims the dataset.cat contains data for “all satellites”, but that is not universally true – only Nix and hydra are included in color cubes, for example.
	+ Lines 106-169: Unlike for other sections, this section on the color/ files does not begin with an introductory sentence or a description of the products in the directory. Please add these.
	+ Line 149: Closing parenthesis missing at end of equation.
	+ Line 183: “this” should be “these”.
	+ Line 479: Contains a “TBD” that needs resolving (the review date).
* dataset\_projection.cat
	+ The addition of IMAGE\_MAP\_PROJECTION objects to the labels would greatly enhance the usability and documentation for these data products by adding key geometry to the labels. Please add them. Trent Hare is standing by to assist.
* index/index.lbl
	+ Lines 127 and 137: The DESCRIPTION of the last two columns is identical. While the statement is true in both cases, some distinction between the two should be mentioned in the DESCRIPTION.
* absorp/ files
	+ Reviewers note that FITS headers with minimal keywords are not particularly useful. If it is possible to get the appropriate mission keyword (as in the typical pipeline data) into these FITS headers, please do.
	+ Flip either the images or the geometry file so that all files are in the same orientation.
	+ Include LINE\_DISPLAY\_DIRECTION and SAMPLE\_DISPLAY\_DIRECTION keywords in all labels explicitly.
	+ The data files appear to contain the value “-99” as a “NoData” value. IMAGE data must use the MISSING\_CONSTANT keyword to indicate such a flag value. Typically, the MISSING\_CONSTANT is set to either the minimum representable value for the data type (“16#FF7FFFFF” for 4-byte reals, for example) or a decimal number than approximates it (“-3.40282e+38”, e.g.) and is out of the range of valid data (in which case the VALID\_MINIMUM keyword should also be supplied – with a different value – to indicate the minimum actual data value).
	+ Similarly, QUBE data objects must use CORE\_NULL to indicate “NoData”. For QUBE data the explicit binary bit pattern (always given in MSB order) is more common.
	+ Linear artifacts were noted in the low signal-to-noise data, apparently the result of flat fielding. [AR: See Karl Hibbitts review presentation slide 4 for illustrations:

<https://pdssbn.astro.umd.edu/review/201805_comet/presentations/Review_LEISA_abs2018.pptx>

In particular, the upper right image.]

* color/ files
	+ Reviewers note that FITS headers with minimal keywords are not particularly useful. If it is possible to get the appropriate mission keyword (as in the typical pipeline data) into these FITS headers, please do.
	+ Include MISSING\_CONSTANT as appropriate for IMAGE data.
	+ Please include wavelength keywords in these labels (as is done in the mosaic/ files): FILTER\_NAME, CENTER\_FILTER\_WAVELENGTH, BANDWIDTH.
	+ Consider using SPECTRAL\_QUBE instead of QUBE, to accommodate GDAL users. [AR: SPECTRAL\_QUBE is a generalization of QUBE. It may or may not make your life easier as you are re-generating things from ISIS3. If it does – great! If not, at least the ‘fix’ is simple for GDAL users, so it’s not tragic. This is also noted as a general comment.]
	+ The specific definitions of “observation angle” and “illumination angle” must be provided.
	+ Jianyang Li lists files that were discovered to have read errors when attempts were made to display them with FITS readers, but not the PDS reader. These files are:
		- mvic\_0298824437\_0x545\_geom\_pl.fit
		- mvic\_0298853042\_0x545\_geom\_pl.fit
		- mvic\_0298853212\_0x536\_geom\_pl.fit
		- mvic\_0298891582\_0x545\_geom\_pl.fit
		- mvic\_0298939122\_0x545\_geom\_pl.fit
		- mvic\_0298939122\_0x545\_sci\_pl.fit
		- mvic\_0298939292\_0x545\_geom\_pl.fit
		- mvic\_0298939292\_0x545\_sci\_pl.fit
		- mvic\_0299176432\_0x536\_geom\_ch.fit

These files need to be fixed. This appears to be a programming error.

[AR: I investigated the first case and discovered that the file claims to be 18 FITS blocks long, but the minimal header is only 1 block, and the data are 48x48x5x4 bytes, which is exactly 16 FITS blocks. So the file contains an extra block. PDS readers don’t care, but FITS readers expect to find a header in a block following data, so FITS readers that are not *very* fault tolerant will fail.]

* + Glen Cushing reports that these files cannot be read by ISIS3, though one would expect them to be:
		- cube\_n\_color\_best.fit
		- cube\_n\_color\_2.fit
		- cube\_h\_color\_best.fit

If possible, investigate why this is the case and correct.

[AR: I took a quick look myself, and I don’t see a reason for it. They appear to me to be well-formatted FITS files, properly padded, and with the correct IMAGE extensions. Since we’re more concerned with the PDS labels being adequate to read the data, this is a low-priority item, but still of interest to our users, who like FITS generally.]

* mosaic/ files
	+ Please add DERIVED\_MAXIMUM, DERIVED\_MINIMUM, and UNIT (if appropriate) to IMAGE objects. [AR: This makes it easier for display software to scale. DERIVED\_MAXIMUM is the maximum data value from the file *after* scaling factor and offset have been applied. If there is no scaling factor or offset, of course, it’s just the maximum valid value in the file. Similarly for DERIVED\_MINIMUM.]
	+ [AR: Note Jianyang Li reported issues with lack of documentation of storage order and IDL read\_PDS routine failing for banded images. These are *not* liens on the data set, as the former is indicated by BAND\_STORAGE\_TYPE for banded IMAGE objects, and the latter is a software issue.]
* spec/ files
	+ All labels have the PRODUCT\_CREATION\_TIME keyword misspelled as “PRODUCT\_CREATON\_TIME”.
	+ The same extra FITS block problem noted in the color/ files was also found here in the following files:
		- 0299026199\_charon\_geometry.fit
		- 0299064869\_charon\_cube.fit
		- 0299064869\_pluto\_cube.fit
		- 0299064869\_pluto\_geometry.fit
		- 0299144829\_pluto\_cube.fit
		- 0299144829\_pluto\_geometry.fit
		- 0299146219\_charon\_geometry.fit
		- 0299176809\_pluto\_cube.fit
		- 0299176809\_pluto\_geometry.fit
		- 0299176809\_pluto\_wavelengths.fit
	+ In the label files, capitalize all letters in the CORE\_UNIT value (there is a lower case “u”, which prevents the standard value from being matched).
	+ Files for geometry labels need to formally define and describe each band using the appropriate keywords (FILTER\_NAME, CENTER\_FILTER\_WAVELENGTH, BANDWIDTH).
	+ All files examined contained no data in channels 199-207 (the last channel of low-res and first 8 channels of hi-res). Turns out this is the location of the glue bond. The labels need to document the missing data flag value appropriately for the data object, and the gap needs to be explained in the documentation.
	+ The “wavelength” files appear to use NaN as an undeclared null-data flag. It is not valid to use NaN in PDS data, and the constant that replaces it need to be defined in the label.
	+ QUBE objects should never use “N/A” in the CORE\_\* keywords.