DART Test LICIACube Collection External Review Report

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Overview

- This is a simulated dataset prepared for the asteroid encounter later this year.
- The bundle is prepared in PDS4 standard and generally good as for this stage of mission.
- This review focused on the data structure, labels and documents
- Data reviewing tools include Oxygen XML Editor, Diff Files, DS9 and python pds4 tools, “pds4_tools.read” and “pds4_tools.view” .

This bundle contains data files associated with LICIACube mission, hosting two different instruments:

- LEIA is a narrow field panchromatic camera *(raw + calibrated)*
- LUKE is a wide field RGB camera *(raw + calibrated)*

Documents

- liciacube/readme.txt

  Generally, all the txt and pdfs have the same problem. For example, there is no DART mission mentioned at all in here. Minimalism looks pretty neat indeed, but for data users it’s more efficient to find needed information within the package. I suggest point out where to find the descriptions about the DART mission, the LICIACube mission, S/C, instruments, calibrations, observation phases and reference lists in the readme.txt.

- 4.4.2.2 a quote Error

overview.txt in each data subdirectory

- In the real data package, add more stats of the data in each collection, e.g. numbers of images, time range of phases, and a complete reference list that sufficiently explains the mission, instrument and calibration...
- Suggest PDS4 tools for reading the images
- Explain the mission phase defined sub-directories

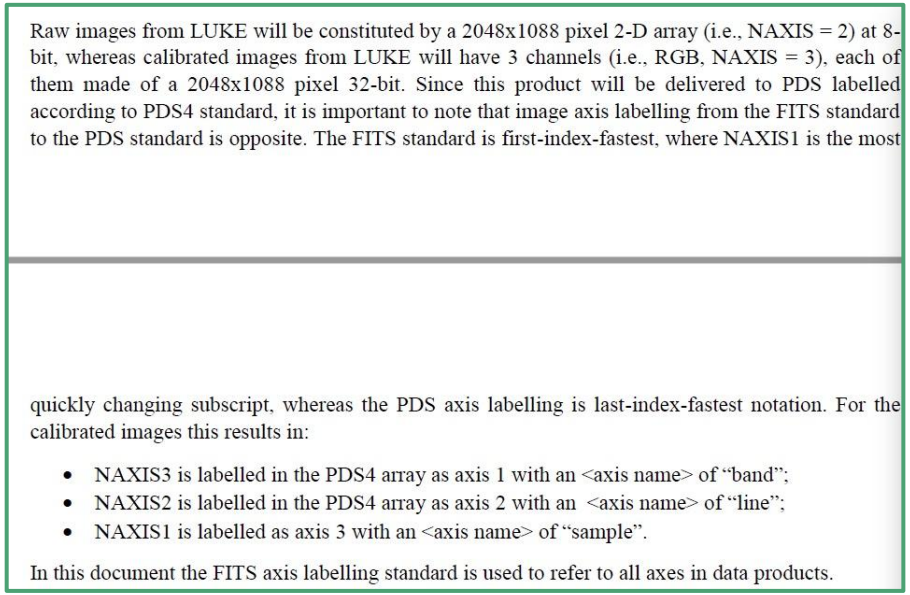
SIS file

- Add a table describe all Acronyms
- In session 4.1. Provide more info in the overview of the DART and LICIACube mission with some key details when producing the real dataset. Such as,

  -mission key phase and dates

  -observation sequence

- LUKE FOV on horizontal and vertical axis?
- Explain Bayer filter and debayer process
- I'm confused by this



Raw images from LUKE will be constituted by a 2048x1088 pixel 2-D array (i.e., NAXIS = 2) at 8-bit, whereas calibrated images from LUKE will have 3 channels (i.e., RGB, NAXIS = 3), each of them made of a 2048x1088 pixel 32-bit. Since this product will be delivered to PDS labelled according to PDS4 standard, it is important to note that image axis labelling from the FITS standard to the PDS standard is opposite. The FITS standard is first-index-fastest, where NAXIS1 is the most

quickly changing subscript, whereas the PDS axis labelling is last-index-fastest notation. For the calibrated images this results in:

- NAXIS3 is labelled in the PDS4 array as axis 1 with an <axis name> of "band";
- NAXIS2 is labelled in the PDS4 array as axis 2 with an <axis name> of "line";
- NAXIS1 is labelled as axis 3 with an <axis name> of "sample".

In this document the FITS axis labelling standard is used to refer to all axes in data products.

- Calibration file are Level-4 product

  or part of calibration documents?

SIS file

- Are all both camera distortion neglectable?
- What about error from calibration?
- Need more explanation on this: “The obtained images for LUKE shall be de-bayerized to obtain the 3 plane of the fits by a standard algorithm used for the RGB scheme of LUKE detector.

  At the present time the filter used is a CFA ‘RGGB’ one, but it can be modified for in-flight images. ”
- Explain the mission phases used in metadata, e.g. what’s TERMINAL and FINAL?
- Add description to “DATE”, make it clear it’s the time of file production

Fits file

All the sample fits (one sample image for each kind) are readable by DS9, python fits.open, PDS4Viewer and PDS4read. It's very nice to have png for easy browsing

```
Filename: /Users/ZOU/WORK/meetings/2022-05-10-PDS-review/luke_raw/prelaunch/liciacube_luke_10_0717839687_18230_01.fit
s
No.    Name      Ver    Type      Cards   Dimensions   Format
  0  PRIMARY       1 PrimaryHDU      64   (2048, 1088)   uint8
```

Luke raw

```
Filename: /Users/ZOU/WORK/meetings/2022-05-10-PDS-review/luke_calibrated/prelaunch/liciacube_luke_12_0717839687_18230
_01.fits
No.    Name      Ver    Type      Cards   Dimensions   Format
  0  PRIMARY       1 PrimaryHDU      73   (2048, 1088, 3)   float32
```

Luke calibrated

```
Filename: /Users/ZOU/WORK/meetings/2022-05-10-PDS-review/luke_calibrated/prelaunch/liciacube_luke_cal_001.fits
No.    Name      Ver    Type      Cards   Dimensions   Format
  0  PRIMARY       1 PrimaryHDU      23   (2048, 1088, 7)   float32
```

Luke cal

```
Filename: /Users/ZOU/WORK/meetings/2022-05-10-PDS-review/leia_raw/prelaunch/liciacube_leia_10_0717839687_18230_01.fit
s
No.    Name      Ver    Type      Cards   Dimensions   Format
  0  PRIMARY       1 PrimaryHDU      66   (2048, 2048)   int16 (rescales to uint16)
```

Leia raw

```
Filename: /Users/ZOU/WORK/meetings/2022-05-10-PDS-review/leia_calibrated/prelaunch/liciacube_leia_12_0717839687_18230
_01.fits
No.    Name      Ver    Type      Cards   Dimensions   Format
  0  PRIMARY       1 PrimaryHDU      69   (2048, 2048)   float32
```

Leia calibrated

```
Filename: /Users/ZOU/WORK/meetings/2022-05-10-PDS-review/leia_calibrated/prelaunch/liciacube_leia_cal_001.fits
No.    Name      Ver    Type      Cards   Dimensions   Format
  0  PRIMARY       1 PrimaryHDU      23   (2048, 2048, 7)   float32
```

Leia cal

```
AOCWZ   =                    0 / Rotation speed of LiciACube frame Z axis
DETTEMP =               18.333 / LUKE detector temperature
WINXSTA =                   -1 / Column where window starts. -1 if second window
WINXEND =                   -1 / Column where window ends. -1 if second windowin
WINYSTA =                   -1 / Row where window starts. -1 if second windowing
WINYEND =                   -1 / Row where window ends. -1 if second windowing n
EPHMETA = 'LCC210701-EMK-RN-L211124-V001.mk' / Ephemeris metakernel to be used
ATTMETA = 'LCC201228-AMK-RN-L221124-V001.mk' / Attitude metakernel to be used
CORT_UTC= '2022-09-30 19:52:54.250' / UTC time at mid-exposure time used to defi
CORTJDAT=            2459853.0 / Julian Ephemeris Date based at mid exposure use
SOCQDATA=                    0 / Spacecraft quaternion computed by the SOC using
SOCQDATX=                    0 / Spacecraft quaternion computed by the SOC using
SOCQDATY=                    0 / Spacecraft quaternion computed by the SOC using
SOCQDATZ=                    0 / Spacecraft quaternion computed by the SOC using
BORE_RA =                    0 / Boresight right ascension
BORE_DEC=                    0 / Boresight declination
CELN_CLK=                    0 / Celestial north clock angle
ECLN_CLK=                    0 / Ecliptic north clock angle
SUN_CLK =                    0 / Sunward direction clock angle
PXARCS  =                    0 / Pixel scale in arcsec
PXMRAD  =                    0 / Instantaneous field of view of a pixel, in micr
PHDIST  =                    0 / Distance between the sun and the primary target
PSCRNG  =                    0 / Distance between the spacecraft and the primary
PSPHASE =                    0 / Angle between the sunward direction and the dir
PSELON  =                    0 / Angle between the sunward direction and the dir
PPPCLK  =                    0 / Positive pole clock angle of the primary target
PSUBLAT =                    0 / Sub-observer latitude of the primary target
PSUBLON =                    0 / Sub-observer east longitude of the primary targ
PSOLLAT =                    0 / Sub-solar latitude of the primary target
PSOLLON =                    0 / Sub-solar longitude of the primary target
SHDIST  =                    0 / Distance between the sun and the secondary targ
SSCRNG  =                    0 / Distance between the spacecraft and the seconda
SSPHASE =                    0 / Angle between the sunward direction and the dir
SSELON  =                    0 / Angle between the sunward direction and the dir
SPPCLK  =                    0 / Positive pole clock angle of the secondary targ
SSUBLAT =                    0 / Sub-observer latitude of the secondary target
SSUBLON =                    0 / Sub-observer longitude of the secondary target
SSSOLLAT=                    0 / Sub-solar latitude of the secondary target
SSSOLLON=                    0 / Sub-solar longitude of the secondary target
```

Header:

- Most descriptions are cut short and incomplete
- IMG_UTC = 'xxx' add description: / start time
- Will there be some metakernel files along with the product?
- Data processing pipeline version and time stamp

XML labels

- All the XML labels for image data: validation fail

Info	Description – 3 items	Resource
	liciacube_leia_l0_0717839687_18230_01.xml, schemas "**PDS4_DISP_1B00.xsd**", "**PDS4_GEOM_1E00_1810.xsd**", "**PDS4_IMG_1E00_1800.xsd**", "**PDS4_DART_1E00_1000.xsd**", "**PDS4_PDS_1E00.xsd**"	
E	E [Xerces] Failed to read schema document 'https://pds.nasa.gov/pds4/mission/dart/v1/PDS4_DART_1E00_1000.xsd', because 1) could not find the document;...	*Resource – Not available*
W	W [Xerces] Failed to read schema document 'https://pds.nasa.gov/pds4/mission/dart/v1/PDS4_DART_1E00_1000.xsd', because 1) could not find the document...	liciacube_leia_l0_0717...
	liciacube_leia_l0_0717839687_18230_01.xml, schema "**PDS4_DART_1E00_1000.sch**" (1 item)	
E	E [Schematron 1.5] 404 Not Found for: https://pds.nasa.gov/pds4/mission/dart/v1/PDS4_DART_1E00_1000.sch	PDS4_DART_1E00_10...

- In XML of SIS.pdf,

  typo: cubseat

  Version in XML is 1.0 but v2 in file name

- For images with browsing png image the XML label is for both fits and png