PDS Data Review

New Horizons
LORRI & MVIC

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General comments

- Many of the files are common between all LORRI and MVIC datasets. Highlight the problems of those files here, and liens should propagate to all data sets.

- Additional comments are given on files that are specific to individual data sets.

LORRI - RAW and CAL

LORRI Instrument

- Narrow angle, panchromatic camera
  - 0.29 degree square FOV
  - high resolution (5 microradian/pixel)
  - 1024x1024 pixel CCD detector
  - Operates in 1x1 or 4x4 on-chip binning modes

- Raw data format
  - FITS files with 5 extensions
    - Primary image, Histogram, First 34 pixels, Image descriptor, Window mismatches
- Calibrated data format
  - FITS files with 3 extensions
    - Primary image (DN), Error map, Quality flag image
    - Do-it-yourself flux calibration: Radiance and Irradiance calibration coefficients are given in the header

General Comments

- Datasets:
  - KEM Cruise phase, Raw and calibrated (1863 images)
- Very similar, with many files the same
- Overall, all data sets are in great shape
- Well documented with lots of description and information available

Various

- Catalog Files
  - DATASET.CAT
    - START_TIME = 2016-10-26T23:59:59.359
    - STOP_TIME = 2017-12-18T23:59:59.772
    - But ABSTRACT_DESC says "This data set contains MVIC [or LORRI] observations taken during and downlinked between Oct. 26, 2016 and Dec. 31, 2017.
    - Difference between phase boundary and data obtained?
  - NH_KEM.CAT
    - typo in KEM1 Cruise phase discussion:
    - "The name and times chose for this mission phase" (chosen)
- Documents Directory
  - DOCINFO.TXT: A number of orphan quote marks:
    - +->MORGAN_SPIE.PDF ", [MORGANETAL2005]
    - +->CONARD_SPIE.PDF ", [CONARDETAL2005]

SPICE Check

- Comparison of my SPICE calculations vs header/label data are generally good (Some kernels are different, so values are not exact)

- Image labels - Solar Elongation is being computed incorrectly :
- LOR_0347962272_0X633_SCI.FIT (MAKEMAKE)
  - PHASE_ANGLE = 32.0 <DEGREE>
    SOLAR_ELONGATION = 148.0 <DEGREE>
  - Phase angle agrees, Solar Elong should be 47.8 deg
    - Triangle 69.7, 52.5, 37.56 AU

- LOR_0347882608_0X633_SCI.FIT (MU69)
  - PHASE_ANGLE = 9.3 <DEGREE>
    SOLAR_ELONGATION = 170.7 <DEGREE>
  - Phase angle agrees, Solar Elong should be 169.3 deg
    - Triangle 5.9, 37.55, 43.3 AU

- Note: Values are correct in the FITS headers of LORRI files, but not included in MVIC files.

Label Geometry Issues

- When star fields are the target, the TARGET-related vectors should not be not valid, but they have entries
  - States that they may not be valid for "N/A",
  - Target of "M7" implies they are meaningful
    - SC_TARGET_POSITION_VECTOR = (-0.022026076 <km>, -0.82088806 <km>,-0.57058897 <km>)
    - SC_TARGET_VELOCITY_VECTOR = (-1.1575802E-16 <km/s>, -1.0747087E-14 <km/s>, -5.8385208E-15 <km/s>)
    - TARGET_CENTER_DISTANCE = 0.99995707 <km>
    - TARGET_SUN_POSITION_VECTOR = (-1580309069.5434349 <km>, 5299278080.3431454 <km>, 2079374825.3264179 <km>)
    - TARGET_SUN_VELOCITY_VECTOR = (-5.5160477 <km/s>, 12.233515 <km/s>, 4.7450032 <km/s>)
    - SOLAR_DISTANCE = 5907920496.4427071 <km>

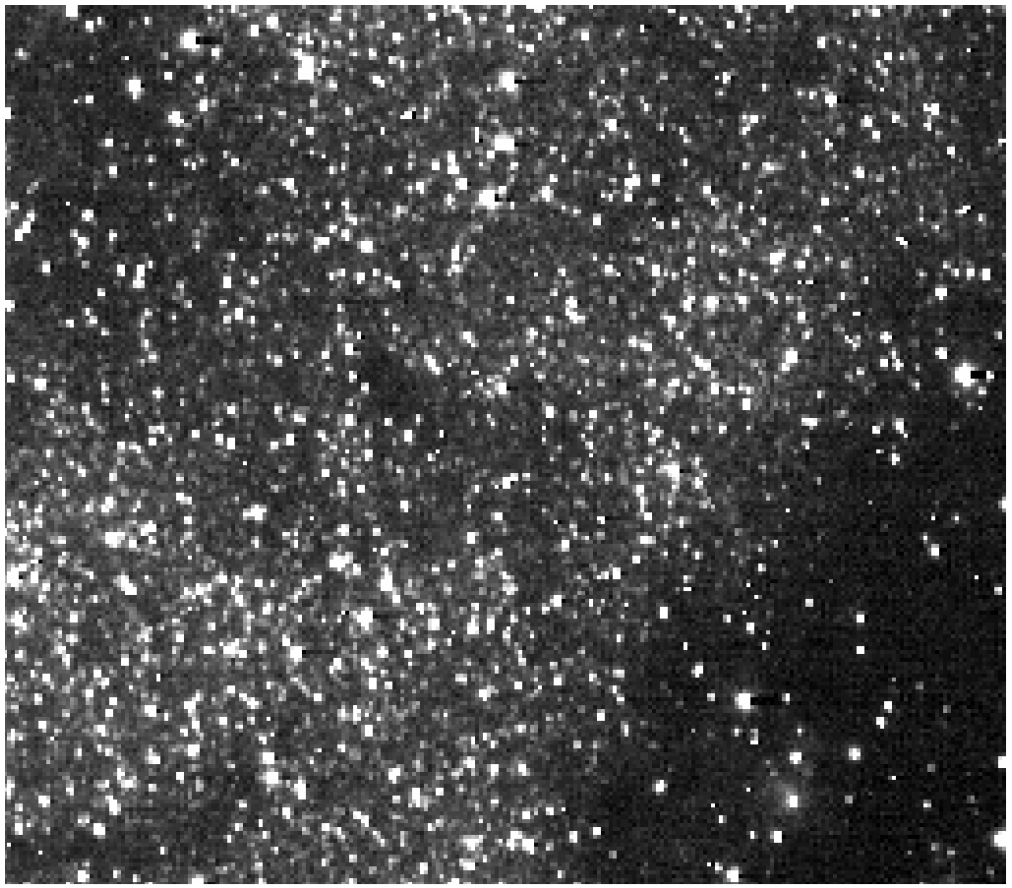
Label Geometry (cont)

- For TARGET = “M7” the label says
  - SC_TARGET_POSITION_VECTOR/_VELOCITY_VECTOR
  - TARGET wrt S/C
  - Light time and stellar aberration correction (per the PDS Data Dictionary) for light originating from Sun, reflected off of and received by S/C at observation midpoint.
- Looks like it is part of the pipeline, but is confusing for non-solar system targets

- If these entries can be taken out or set to N/A for calibration objects, that would be great. Otherwise, include some text noting that for calibration objects they are invalid.

Data

- Data are in good shape
  - Read with IDL FITS readers, PDSREAD and NASAView
  - Includes extensions
  - Read and displayed every image
- Tested and manipulated randomly selected data
- Not clear what values should be used for calibration
  - Pluto, Charon, Sun, etc are included in headers
  - Some guidance on what calibration coefficients to use for Distant KBOs would be useful



LORRI Status

- A few minor changes to documents and labels
- Data are Certifiable

MVIC - RAW and CAL

MVIC Instrument

- Part of the RALPH instrument

- PanFrame CCD
  - 5024x128 pixels sweep over the scene
  - 128 pixels per exposure time
  - Create an image cube 5024 x 128 x XXX pixels, where XXX is defined by scan rate and time
  - Not clear how these data are used, though there are not many of them
- Six other CCDs operate in TDI mode (different filters)
  - 5024x32 pixels sweep over the scene
  - The 32 pixels are clocked at the scan rate, so each exposure time gives a shift of 1 pixel
  - Creates an image 5024 x XXX

- Raw data format
  - FITS files with 3 extensions
    - Primary image, housekeeping, window mismatch table
- Calibrated data format
  - FITS files with 3 extensions
    - Primary image (DN), Error map, Quality flag image
    - Do-it-yourself flux calibration: Flux conversion coefficients are added to the header

General Comments

- Datasets:
  - KEM Cruise phase, Raw and calibrated (11 image cubes)
- Very similar, with many files the same
- Overall, all data sets are in great shape
- Well documented with lots of description and information available
- Slides 6-9 (above) apply to MVIC as well

MVIC Data Files – RAW and CAL

- Able to read the data with both PDSREAD and IDL FITS readers
- Able to manipulate the data
- Not clear what values should be used for calibration
  - Pluto, Charon, Sun, etc are included in headers
  - Some guidance would be useful

MVIC Status

- A few minor changes to documents and labels
- Data are Certifiable