# PDS Data Review

# New Horizons
# LORRI & MVIC

Tony Farnham

Feb 10, 2022

# LORRI - RAW and CAL

# LORRI Instrument

- Narrow angle, panchromatic camera
  - 0.29 degree square FOV
  - High resolution (5 µrad/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

- Two Datasets:
  - KEM1 Encounter phase, V5.0, Raw and Calibrated (8812/8744 images)
    - 16 Aug 2018 – 31 Dec 2020

- Extends the date over V4.0
  - Fills in additional downloaded data
  - Adds other KBO targets

- Overall, both data sets are in great shape

- Well documented with lots of description and information available
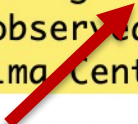
# Various

- DATASET.CAT

  - Several references to Arrakoth call it MU69.  Should be 2014 MU69

  > The data set contains many observations of distant Kuiper Belt Objects
  > (DKBOs), as well as images of the approach and departure field around
  > MU69 (Arrokoth). The imaged DKBOs include: 2011 HK103, 2011 JW31,
  > 2011 JY31, 2011 HF103, 2014 OS393, 2014 PN70, 2011 HZ102, 2014 OE394,
  > 2011 JA32, 2004 LW31, 2018 MF13, 2011 JX31, and 2014 OJ394.
  > The approach field images were used for navigation and hazard avoidance
  > purposes. During MU69's encounter LORRI did LightCurves and Imaging.
  > LORRI also observed Triton, M7, NGC3532, HD37962, Quaoar, MS4, Zodiacal
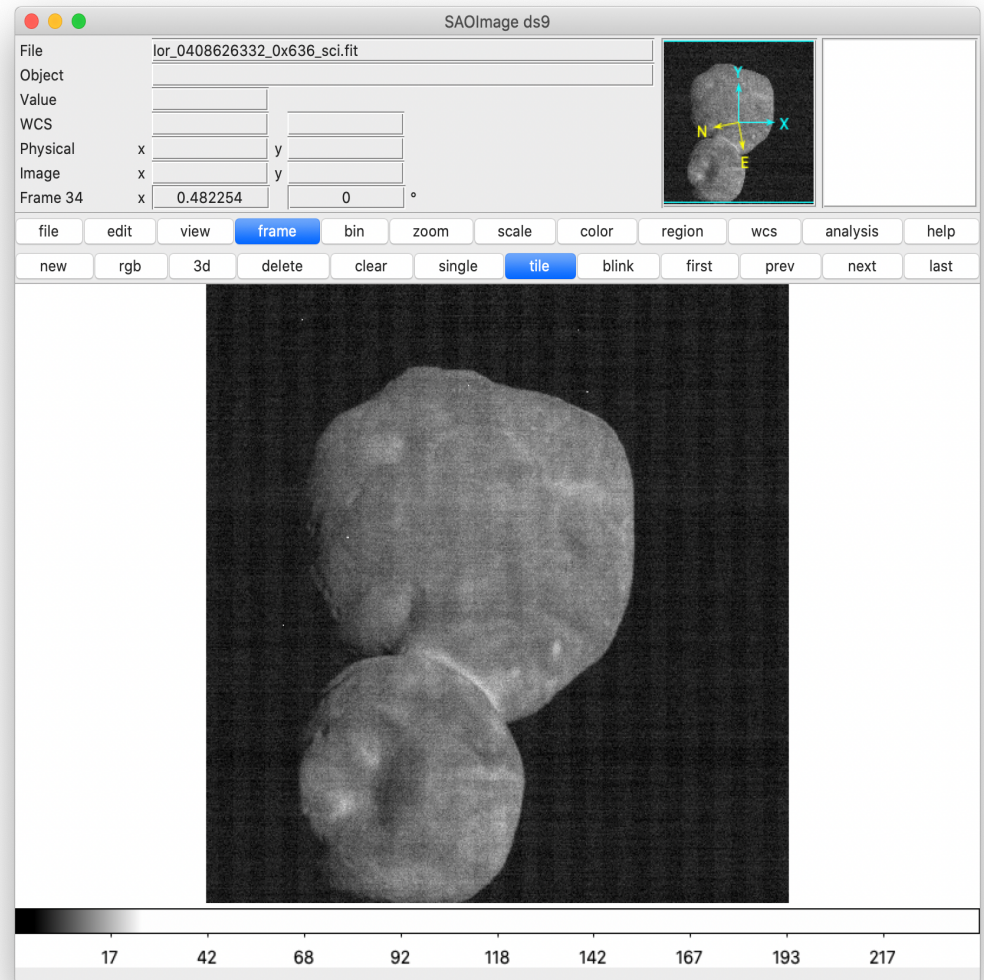  > Light, Proxima Centauri, and Wolf 359.

  > It includes images of the approach and departure field around MU69
  > (Arrokoth). The data cover the actual MU69 encounter.
  > "

  - Also occurs in NH_KEM.cat

# Data

- Data are in good shape
    - Read with IDL FITS readers and PDSREAD
    - Includes extensions
    - Read and displayed every image
    - Tested to make sure data could be manipulated and measured

# Data

- One issue
  - 68 files in the raw data set are not in the calibrated set.
  - All from one directory (all files in 20200606_045371)
  - Most have target "N/A" but some have "2011 JX31"
  - Looks like all pixel values are 0 in each image
    - Except for the 38 header pixels
- No explanation for what these are, or why they are included in the raw data  (is there a plan available somewhere?)

- Should probably leave them out (with documentation?)

# SPICE

- I don't have updated SPICE kernels for the time that was added to this review.
  - Can't comment on the accuracy of the geometry in the headers and labels.


- Relevant to both the LORRI and MVIC data

# LORRI Status

- 68 files in raw dataset are not in calibrated dataset
  - Either remove them or describe why they are included

- Typos in the DATASET.CAT file

- 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
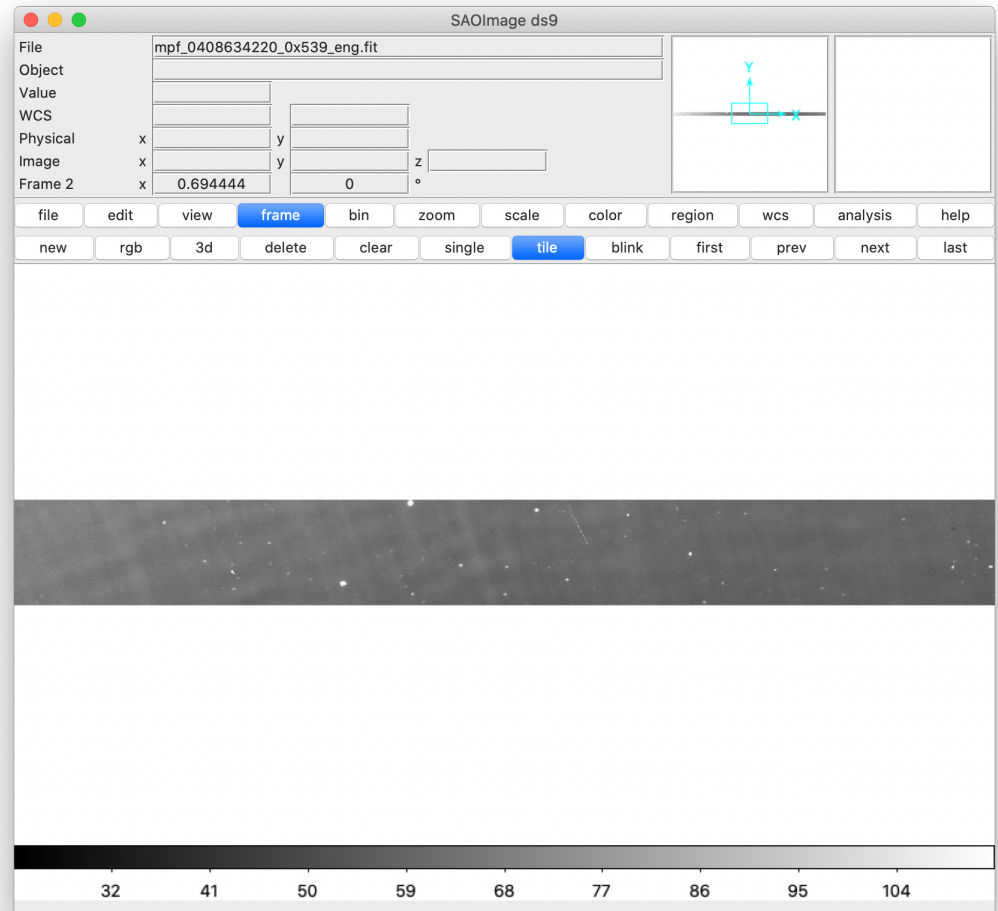
# General Comments

- Two datasets:
  - KEM1 Encounter phase, V5.0, Raw and calibrated  (359 images)
    - 31 Aug 2018 – 02 Sep 2019

- Extends the date over V4.0
  - Adds additional downloaded data

- Overall, both data sets are in great shape

- Well documented with lots of description and information available

# Catalog Files

- DATASET.CAT and NH_KEM.cat
  - Same issue with MU69 as in LORRI dataset

# MVIC Data Files – RAW and CAL

- Data are in good shape
  - Read with IDL FITS readers, PDSREAD.
  - Includes extensions
  - Read and displayed every image
  - Tested to make sure data could be manipulated and measured
- One-to-one correspondence between raw and calibrated files

# MVIC Status

- A minor change in DATASET.CAT file

- Data are Certifiable