DART Data Review: DRACO

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Data overview:

- Dart DRACO **raw** and **calibrated** packages from:
  - Commissioning
  - Cruise
  - Approach
  - **Terminal**
  - **Final**
- PDS version: PDS4

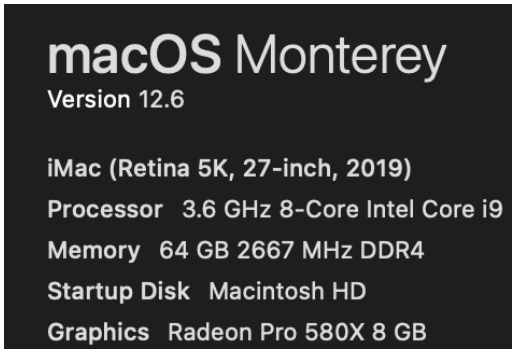
urn:nasa:pds:dart:data_dracocal::2.0	Draco Calibrated Data Collection for the Didymos Reconnaissance and Asteroid Camera for OpNav (DRACO) instrument v2.0
urn:nasa:pds:dart:data_dracoraw::2.0	Draco Raw Data Collection for the Didymos Reconnaissance and Asteroid Camera for OpNav (DRACO) instrument v2.0
urn:nasa:pds:dart:document_draco::2.0	Documentation for the Didymos Reconnaissance and Asteroid Camera for OpNav (DRACO) instrument v2.0

- Total images: about 500,000
- Time range: `2021-12-02` to `2022-09-26`

Review summary:

The third time reviewing DART. Problems from our previous reviews are well addressed. For this review, the image packages are very large (>1TB). I could not download the whole package because of my limited local space. So I focused my review on the images of Terminal and final packages and also checked a few sample images from previous packages. I checked image files, header, XML labels with both my own tools and *PDS4_tools*. The documentation and calibration are also checked. Generally good condition, only a few minor issues.

Review environment and tools:



Tools:

- Python Jupyter notebook 6.0.3
- PDS4_Tools v1.3

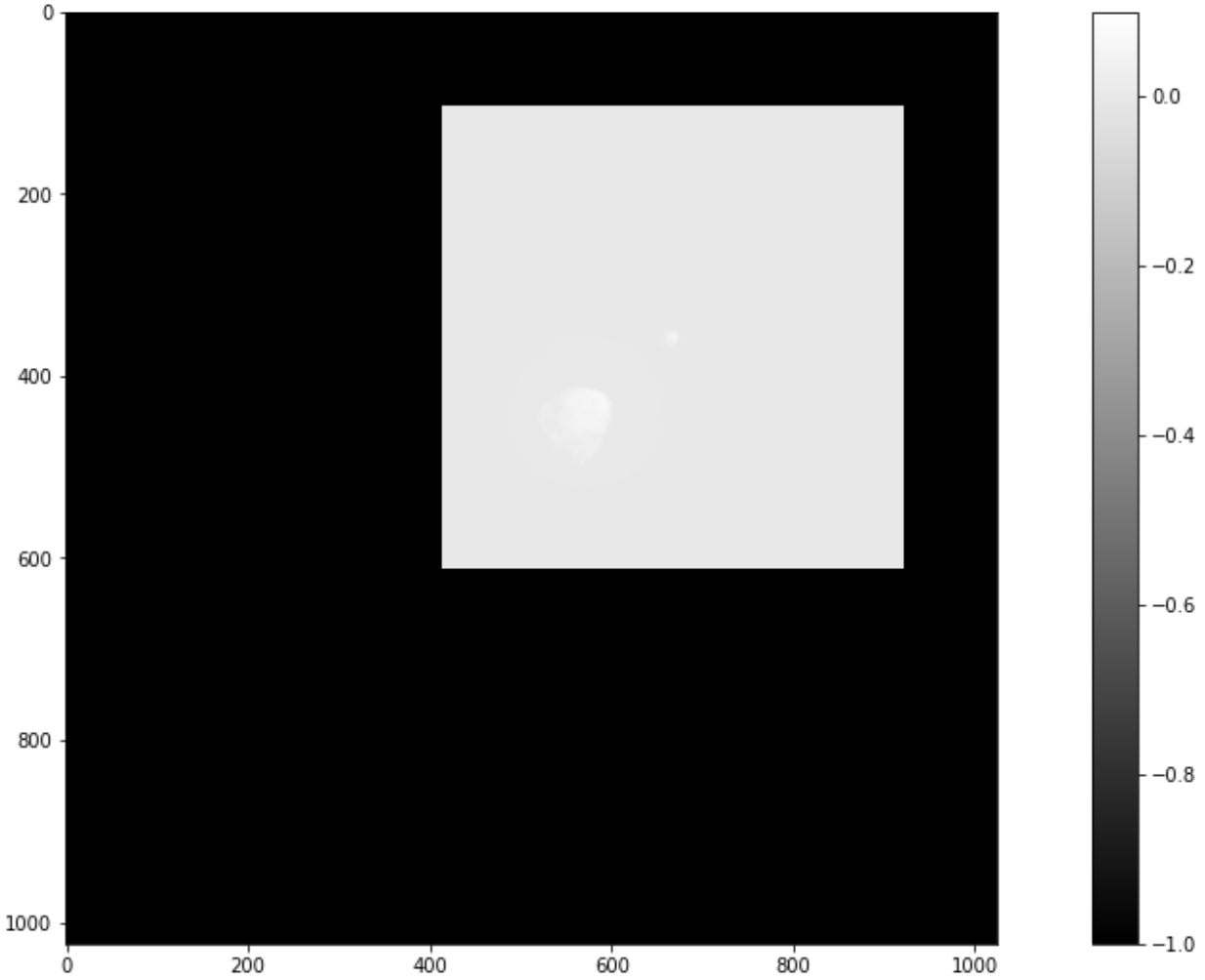
- Oxygen XML Editor 23.1
- Adobe Acrobat Reader DC 2019
- Beyond Compare 2

Review details:

1. Data and labels

- Readable with PDS4_tools viewer and read tool, DS9, python fits tool
- 1024x1024 images with 512x512 window, value = -1E10

data_dracocal/terminal/2022/269/dart_0401929787_00585_01_iof.xml



DART/data_dracocal/final/2022/269/dart_0401930036_19689_01_iof.xml

Label

Array_2D_Image
local_identifier: dart_0401930036_19689_01_iof
offset: 23040
axes: 2
axis_index_order: Last Index Fastest

Element_Array
data_type: IEEE754MSBSingle
unit: W*m**-2*sr**-1*nm**-1

Axis_Array
axis_name: Line
elements: 1024
sequence_number: 1

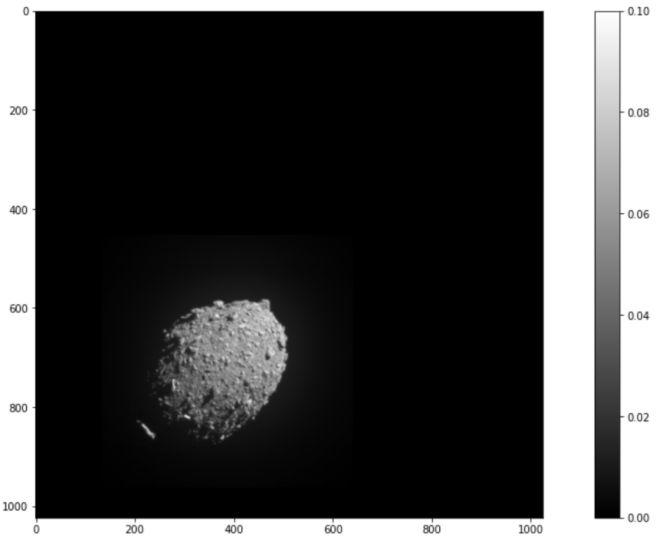
Axis_Array
axis_name: Sample
elements: 1024
sequence_number: 2

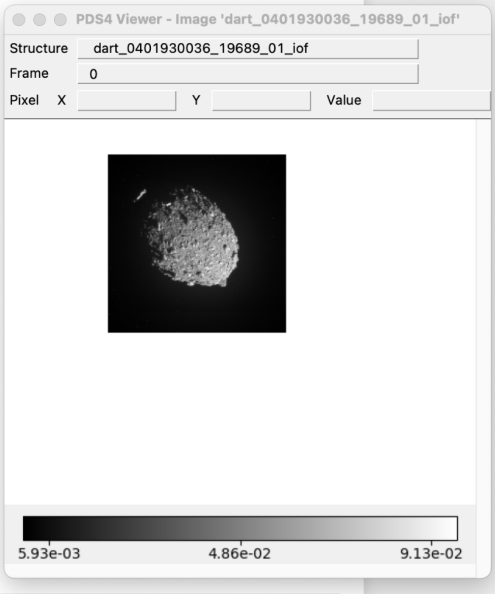
Special_Constants
missing_constant: 1E10
invalid_constant: -1E09
not_applicable_constant: -1E10
high_instrument_saturation: 1E09

```
structures = pds4_tools.read(name)
image = structures[1].data
plt.figure(figsize=(18,9))
plt.imshow(image, cmap = 'gray', vmin=0, vmax=0.1)
plt.colorbar()
```

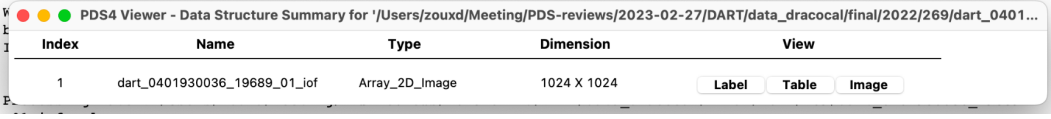
```
Processing label: /Users/zouxd/Meeting/PDS-reviews/2023-02-27/DART/data_dracocal/final/2022/269/dart_0401930036_19689
_01_iof.xml
Now processing a Header structure: HEADER_0
Now processing a Array_2D_Image structure: dart_0401930036_19689_01_iof
```

.1]: <matplotlib.colorbar.Colorbar at 0x7fb1a8760210>





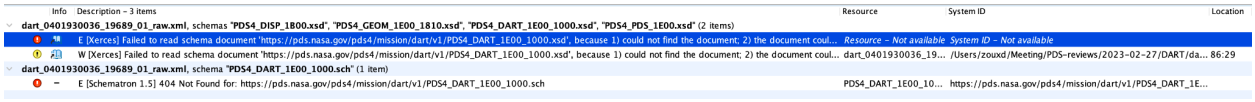
*]:
```
pds4_tools.view(name)
```



DART/data_dracocal/final/2022/269/dart_0401930036_19689_01_iof.png

- Comparing the loaded image using “pds4_tools_read()” and “pds4_tools.view()”, the image flipped. Since we have png for checking the orientation, this is not a problem for the data set.
- If I use “pds4_tools.view()”, the image frame border disappears, because it shows the negative value the same white as background (not a problem but may be confusing to some data users).
- Label info is quite simple. Key info is all in header. Legit?
- Header:
    - Suggest adding pixel value description and unit.
    - Header is written as the first extension of the fits file. Not as fits header.

- Unit for I/F in the label is wrong.
- A lot of information, about the imaging condition, geometry, calibration… should all be mentioned in the label.
- XML: validation error



2. Documentation

- Verify the calibration instruction of the second last image. Follow the instructions in “Calibration Pipeline Description“ file, and use the calibration files from the header, the results matched the calibrated file.

- Minor issue, there are two different “onboard cal table ”. No instruction regarding which one to choose. Related hearder tag is:
  `ONBRDCAL= 'UNDONE  '           / On-board cal table status`
- Two same “Dark current frames”?
  `REFDARK1= 'draco_dark_global_1x_n20c_20210225.fits' / ref dark file`
  `REFDARK2= 'draco_dark_global_1x_n20c_20210225.fits' / ref dark file`

3. Geometry
   Did not check. No available shape model.