DART Data Review: DRACO

Reviewer: Xiao-Duan Zou (Planetary Science Institute)

Sep 15 2023

1. **Overview:**

Bundle: PDS4 standard

Time range: 2021-12-02 to 2022-09-26

This bundle contains data files associated with the DART DRACO instrument. Hosting raw, calibrated, derived and document packages from:

- Commissioning
- Cruise（**23 packages for raw and cal data**）
- Approach
- **Terminal**
- **Final**

Total images: ～0.5 million

	raw	calibrated	derived
Commissioning Cruise Approach	245654	232993	0
Terminal	13400	13400	0
Final	236	236	60
Total	259290	246629	60

Review summary:

Problems from our previous reviews are well addressed. For this review, the image packages are very large (>0.5million images). I did not download the whole package because of my limited local space. So I focused my review on the images of the last small package of Cruise, the whole package of Terminal and Final packages. I checked image files, header, XML labels with both my own tools and *PDS4_tools*. The documentation and calibration are also checked. The dataset is now in good condition with a few issues needed fixing.

2. Review process:
Review environment:

macOS Monterey
Version 12.6

iMac (Retina 5K, 27-inch, 2019)
Processor   3.6 GHz 8-Core Intel Core i9
Memory   64 GB 2667 MHz DDR4
Startup Disk   Macintosh HD
Graphics   Radeon Pro 580X 8 GB

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 steps:

- Double checked a few items from the previous reviews.
- Compare differences between sets.
- Read data files and label files.
- Check the headers and XML labels.
- Compare datasets, and analyze the difference.
- Check documents.
- Collect aspect data from all image headers, check consistency.

3. Documents:
- Generally sufficient, and all the issues from previous review solved.
- The DRACO Keyword Cheat Sheet in the SIS file is a very nice feature to have!!
- SIS file is in editing mode, not yet cleaned.

- All the documents have been updated to different versions, but the overview.txt still referenced the old version. Please update them all.

- This is not a problem, but I'd like to point out that the DRACO and LICIACube datasets spell a few KEYWORDS differently, (which is a pain for me when trying to use both).

4. XML Labels:

- **Validation problem**

- **Problem when read labels of calibration files:**

Message:

"Now processing a Table_Character structure: draco_lookup_rolling_1x_20230210

Error: An error occurred during data read-in.

Traceback (most recent call last):

  File "/opt/anaconda3/lib/python3.7/site-packages/pds4_tools/viewer/summary_view.py", line 171, in _reify_structure
    structure.data

  File "/opt/anaconda3/lib/python3.7/site-packages/pds4_tools/extern/cached_property.py", line 86, in __get__
    return obj_dict.setdefault(name, self.func(obj))

  File "/opt/anaconda3/lib/python3.7/site-packages/pds4_tools/reader/table_objects.py", line 363, in data
    read_table_data(self, no_scale=self._no_scale, decode_strings=self._decode_strings, masked=self._masked)

  File "/opt/anaconda3/lib/python3.7/site-packages/pds4_tools/reader/read_tables.py", line 940, in read_table_data
    .format(field['name'], field.data_type(), repr(e.args[0]))), None)

  File "<string>", line 3, in raise_from

ValueError: Unable to convert field 'rowStart' to data_type 'ASCII_NonNegative_Integer': "invalid literal for int() with base 10: b'0,511'"

"

Also, the description in these labels looks weird.

```
Field_Character
      name: rowStart
      field_number: 1
      field_location: 1
      data_type: ASCII_NonNegative_Integer
      field_length: 5
      description:
                  start row in the DRACO image for which this
                  record applies.

Field_Character
      name: rowEnd
      field_number: 2
      field_location: 7
      data_type: ASCII_NonNegative_Integer
      field_length: 5
      description:
                  end for in the DRACO image for which this
                  record applies.

Field_Character
      name: DN
      field_number: 3
      field_location: 13
      data_type: ASCII_NonNegative_Integer
      field_length: 6
      description: the DN lookup value.

Field_Character
      name: electrons
      field_number: 4
      field_location: 20
      data_type: ASCII_Real
      field_length: 16
      description:
                  electron value to use given the DN
                  lookup value.
```
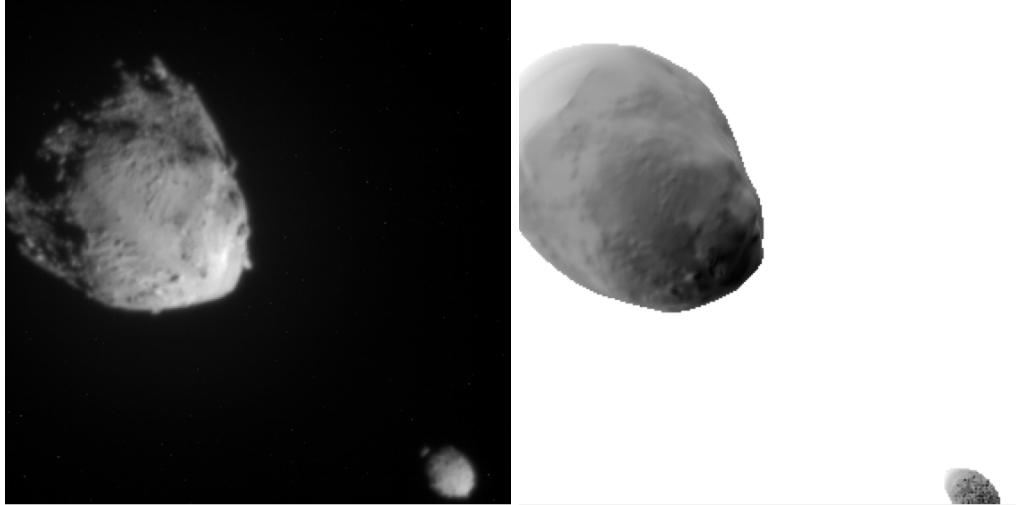
- **Start time and stop time are at different lengths (in all image data XMLs).**
  <start_date_time>2022-09-26T23:10:01.429Z</start_date_time>
  <stop_date_time>2022-09-26T23:10:01.433986Z</stop_date_time>x

5. **Data files:**
   - **Read normally: all data image files good.**

   - **Geometry**
     - Read keywords from head of final cal images and plot the trend to compare

     - Check the backplanes' registration to the image in the derived dataset

Dart_0401929893_44487_01_geo

Didymos matches very well while Dimorphos does not. Generally good condition. Proof of the SPICE results.

- **Calibration**
  All clearly described and easy to understand procedures.

6. **Other small edits:**
   - In "overview_data_dracoraw.txt"
     "The calibration table subtraction is effectively a bias subtraction, and improves the performance of SMART Nav targeting." remove the comma

   - In "didymos_coordinate_system_description_v1.xml"
     "The coordinate system of Didymos is baesd on a shape model derived from images taken by the Didymos" → based

   - The PDFs could benefit from a auto batch edit correction for small format issues, such as, "insert a space between words and parentheses", "add a comma after all the e.g. and i.g.", "remove commas before ands" and spell check for small typos.
   - In "xxxxxx_sis_v3.pdf", "Note, to show an image as an observer looking out the DRACO boresight would see, it has to be flipped vertically to place the origin at the lower left (see Section 4.1.6.2)." has to → must
     i. "... at a later time" → later
     ii. "This issue did not not affect large numbers of images, and did not affect any images taken in the Terminal and Final Phases. Remove a "not"