Lunar Reconnaissance Orbiter Mission Namespace

NASA Planetary Data System

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USER GUIDE

The Lunar Reconnaissance Orbiter (LRO) Mission was launched June 18,2009. The LRO mission data were originally developed and archived in PDS3 format. This dictionary was developed as part of the PDS4 migration effort and includes all phases of the primary and extended mission.

CHAPTER

ONE

INTRODUCTION

This *User's Guide* provides a brief overview of the Lunar Reconnaissance Orbiter Mission (LRO or "lro:") namespace for those working with data from Lunar Reconnaissance Orbiter primary or extended missions.

> **Note** *that the Lunar Reconnaissance Orbiter legacy data migration is still active, with labels still being designed for some remaining instruments. This namespace is in active development and will continue to be so for the near future.*

Data from the LRO mission was originally archived in PDS3 format and migration to PDS4 is underway.

This guide presents the major features of the namespace.

CHAPTER

TWO

OVERVIEW OF THE LUNAR RECONNAISSANCE ORBITER (LRO) MISSION DICTIONARY

The Lunar Reconnaissance Orbiter (LRO) Mission was launched June 18,2009. The LRO mission data were originally developed and archived in PDS3 format. This dictionary was developed as part of the PDS4 migration effort and includes all phases of the primary and extended mission.

- **Primary Steward:** GeoScience Node
- **Dictionary Repo:** https://github.com/pds-data-dictionaries/ldd-lro
- **Namespace Prefix:** lro:

Corrections, changes, and additions should be submitted through the PDS LDD Issue Repo.

CHAPTER

THREE

ORGANIZATION OF CLASSES AND ATTRIBUTES

The Lunar Reconnaissance Orbiter dictionary has a single top-level class that must be used to access any of the LRO metadata classes. Below that, there are major subclasses for metadata that is common to all (or multiple instruments), as well as classes specific to particular instruments. Processed and calibrated data will generally have additional classes to provide instrument-specific processing details.

The following sections describe the major divisions of the Lunar Reconnaissance Orbiter Mission namespace, in the order in which they occur in the schema (and thus, labels).

3.1 Top-Level Class: <lro:LRO_Parameters>

The *<lro:LRO_Parameters>* class acts as a wrapper for all other LRO classes. At this level all attributes and (as of this writing) instrument classes are optional.

Although optional all labels should contains the attribute, *<lro:mission_phase_name>*, with the string identifying the mission phase. Mission phase names are unique to the primary or extended mission in which they occur. Available values are from *LAUNCH* through extended phases.

The major subclasses of the *<lro:LRO_Parameters>* class are for the various instruments on LRO:

- *<lro:Diviner_Parameters>*
- *<lro:LOLA_Parameters>*
- *<lro:LROC_Parameters>*
- *<lro:MiniRF_Parameters>*

You can see a top-level outline of the namespace under the *Lunar Reconnaissance Orbiter (LRO) Mission Top-level Namespace Outline* topic.

3.2 Subclass: <lro:Diviner_Parameters>

The *<lro:Diviner_Parameters>* class provides details specific to the Diviner experiment.

The Diviner Lunar Radar Experiment is a multi-channel solar reflectance and infrared radiometer that maps the temperature of the lunar surface at 500-meter horizontal scales. Diviner data sets are produced by the Diviner Science Team at the University of California, Los Angeles.

3.3 Subclass: <lro:LOLA_Parameters>

The *<lro:LOLA_Parameters>* class provides details specific to the Lunar Orbiter Laser Altimeter (LOLA).

LOLA is a pulse detection, time-of-flight laser altimeter. LOLA transmits a 5-spot pattern that measures the precise distance to the lunar surface at multiple points simultaneously, thus providing 5 profiles across the lunar surface. Each spot within the five-spot pattern has a diameter of approximately five meters; the spots are approximately 25 meters apart in the nominal 50-km-high mapping orbit in the form of a cross canted by 26 degrees counterclockwise, repeating approximately every 57 meters along-track. These spots provide up to five adjacent profiles whose separation depends on spacecraft altitude. The data set consists of uncalibrated observations, also known as EDRs. It is a time series collection of science and housekeeping data from LOLA, aggregated exactly as they are stored on the LRO spacecraft before being downlinked. Except where noted, they are complete and free from duplicates or errors.

3.4 Subclass: <lro:LROC_Parameters>

The *<lro:LROC_Parameters>* class provides details specific to the Lunar Reconnaissance Orbiter Camera suite.

The LRO Camera consists of two Narrow Angle Cameras (NACs) that provide 0.5 meter-scale panchromatic images over a combined 5 km swath, a Wide Angle Camera (WAC) to provide images at a scale of 100 meters/pixel in seven color bands over a 60 km swath, (during the nominal 50 km primary mission phase) and a Sequence and Compressor System (SCS) supporting data acquisition for both cameras. LROC is a modified version of the Mars Reconnaissance Orbiters ConTeXt Camera (CTX) and MARs Color Imager (MARCI), built by Malin Space Science Systems (MSSS) in San Diego, CA. The two NAC, WAC and SCS are located on the LRO Instrument bench, with NAC/WAC respective boresights aligned with the nadir (+Z) axis of the spacecraft.

3.5 Subclass: <lro:MiniRF_Parameters>

The *<lro:MiniRF_Parameters>* class provides details specific to the Mini-RF experiment.

Mini-RF is the Miniature Radio Frequency technology demonstration of a miniaturized multi-mode dual frequency dual polarization radar observatory. Mini-RF data sets are produced by the Mini-RF Science Team at the Johns Hopkins University Applied Physics Laboratory, Laurel, MD

CHAPTER

FOUR

LUNAR RECONNAISSANCE ORBITER (LRO) MISSION TOP-LEVEL NAMESPACE OUTLINE

<lro:LRO_Parameters> is the public entry point to the Lunar Reconnaissance Orbiter Mission namespace. This class contains all other LRO classes and must be included to gain access to them. Below is a summary outline of the top-level attributes and instrument classes currently available in the LRO mission dictionary.

Note that there are no real cases in which every single mission class and attribute would appear in a single label.

```
<lro:LRO_Parameters>
  <lro:product_type>
  <lro:product_version_id>
  <lro:orbit_number>
  <lro:start_orbit_number>
  <lro:stop_orbit_number>
  <lro:start_solar_longitude>
  <lro:stop_solar_longitude>
  <lro:mission_phase_name>
  <lro:spacecraft_clock_count_partition>
  <lro:spacecraft_clock_start_count>
  <lro:producer_full_name>
  <lro:producer_institution_name>

  <!-- Class for Diviner labels -->
  <lro:Diviner_Parameters>
      `Diviner Attributes <https://pds.nasa.gov/datastandards/documents/dd/current/PDS4_
↪PDS_DD_1M00/webhelp/all/#ch34s02.html>`_

  <!-- Class for LROC NAC and WAC labels -->
  <lro:LROC_Parameters>
      `LROC Attributes <https://pds.nasa.gov/datastandards/documents/dd/current/PDS4_PDS_
↪DD_1M00/webhelp/all/#ch34s05.html>`_

  <!-- Class for LOLA labels -->
  <lro:LOLA_Parameters>
      `LOLA Attributes <https://pds.nasa.gov/datastandards/documents/dd/current/PDS4_PDS_
↪DD_1M00/webhelp/all/#ch34s04.html>`_

  <!-- Class Mini-RF labels -->
  <lro:MiniRF_Parameters>
      `Mini-RF Attributes <https://pds.nasa.gov/datastandards/documents/dd/current/PDS4_
↪PDS_DD_1M00/webhelp/all/#ch34s08.html>`_
```

CHAPTER

FIVE

ALPHABETICAL LIST OF CLASSES

A complete list of all classes in the Lunar Reconnaissance Orbiter (LRO) Mission Dictionary, in alphabetical order, is available through the PDS4 Data Dictionary page, which is regenerated automatically with each release of the PDS4 Information Model.

To find the Lunar Reconnaissance Orbiter (LRO) Mission class list, look down the list of (alphabetically sorted) dictionary prefixes in the left menu for "Classes in the lro namespace". Select that item and the list of classes will be presented on both the left and the right as clickable links.

Clicking on the specific class name will produce a grid with the full, formal definition of the class.

Clicking on the class name in the "Referenced from:" line at the bottom of the grid will take you to the containing class, where you can see the cardinality of the class (i.e., whether it is required, optional, or repeatable) in the containing class.

You can also click on the attribute names listed to see details of the attribute definitions.

CHAPTER

SIX

ALPHABETICAL LIST OF ATTRIBUTES

A complete list of all attributes in the Lunar Reconnaissance Orbiter (LRO) Mission Dictionary, in alphabetical order, is available through the PDS4 Data Dictionary page, which is regenerated automatically with each release of the PDS4 Information Model.

To find the Lunar Reconnaissance Orbiter (LRO) Mission attribute list, look down the list of (alphabetically sorted) dictionary prefixes in the left menu for "Attributes in the lro namespace". Select that item and the list of attributes will be presented on both the left and the right as clickable links.

Clicking on the specific attribute name will produce a grid with the full, formal definition of the attribute, including data type, restrictions on values, and the list of defined permissible values (if any) and their definitions.

Note that attributes might appear as members of different classes, and that their definitions, or more likely their permissible values, might be context-dependent.

Clicking on the class name in the title bar of the attribute grid will take you to the definition of the class containing that attribute.

If the attribute has an associated unit of measure type, that attribute *must* have an XML attribute called "unit" in its tag when it is used. For example:

```
<lro:temperature_telescope unit="degC">6.04956</lro:temperature_telescope>
```

You can see valid values to use for the "unit=" XML attribute by clicking on the value of "Unit of Measure Type" in the grid.

CHAPTER

SEVEN

EXAMPLE LROC LABELS

The labels were created for the migration of LROC NAC, WAC, and derived stereo.

Mockup labels can be found in the Lunar Reconnaissance Orbiter Mission Dictionary GitHub repo: https://github.com/pds-data-dictionaries/ldd-lro. They are in the *test/examples/* directory. Available mockups are:

- LROC NAC left-channel Raw (M102600893LE_VALID)
- LROC NAC left-channel Calibrated (M102600893LC_VALID)
- LROC WAC Calibrated (M102601080CC_VALID)
- LROC NAC derived digital elevation model (NAC_DTM_A12LMAS_VALID)

CHAPTER

EIGHT

LABEL: M102600893LE_VALID, RAW DATA

This label is a mockup created for design purposes. The data file it describes contains the raw data for LROC NAC image M102600893LE.

The label shows the entire <*Product_Observational*> structure including the dictionary classes, which are found in the <*Mission_Area*> of the structure. It is a valid label, except for the specified path/location of the mission dictionary .xsd file, which should be updated prior to attempting to validate it.

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-model href="https://pds.nasa.gov/pds4/pds/v1/PDS4_PDS_1J00.sch" schematypens=
↪"http://purl.oclc.org/dsdl/schematron"?>
<?xml-model href="https://pds.nasa.gov/pds4/mission/lro/v1/PDS4_LRO_1J00_1020.sch"␣
↪schematypens="http://purl.oclc.org/dsdl/schematron"?>
<?xml-model href="https://pds.nasa.gov/pds4/disp/v1/PDS4_DISP_1J00_1510.sch"␣
↪schematypens="http://purl.oclc.org/dsdl/schematron"?>
<?xml-model href="https://pds.nasa.gov/pds4/img/v1/PDS4_IMG_1J00_1870.sch" schematypens=
↪"http://purl.oclc.org/dsdl/schematron"?>

<Product_Observational
  xmlns="http://pds.nasa.gov/pds4/pds/v1"
  xmlns:pds="http://pds.nasa.gov/pds4/pds/v1"
  xmlns:disp="http://pds.nasa.gov/pds4/disp/v1"
  xmlns:lro="http://pds.nasa.gov/pds4/mission/lro/v1"
  xmlns:img="http://pds.nasa.gov/pds4/img/v1"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"

  xsi:schemaLocation="http://pds.nasa.gov/pds4/pds/v1 https://pds.nasa.gov/pds4/pds/v1/
↪PDS4_PDS_1J00.xsd
  http://pds.nasa.gov/pds4/mission/lro/v1 https://pds.nasa.gov/pds4/mission/lro/v1/PDS4_
↪LRO_1J00_1020.xsd
  http://pds.nasa.gov/pds4/disp/v1 https://pds.nasa.gov/pds4/disp/v1/PDS4_DISP_1J00_1510.
↪xsd
  http://pds.nasa.gov/pds4/img/v1 https://pds.nasa.gov/pds4/img/v1/PDS4_IMG_1J00_1870.xsd
↪">

  <Identification_Area>
    <logical_identifier>urn:nasa:pds:lro-l-lroc-2-edr:lrolrc_0001_data:nac.m102600893le</
↪logical_identifier>
    <version_id>2.0</version_id>
    <title>Lunar Reconnaissance Orbiter Camera NAC EDR Product</title>
    <information_model_version>1.19.0.0</information_model_version>
    <product_class>Product_Observational</product_class>
```

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```
    <Alias_List>
      <Alias>
        <alternate_id>M102600893LE.IMG</alternate_id>
        <comment>Original filename at PDS3 archive, on-line at LROC Node</comment>
      </Alias>
      <Alias>
        <alternate_id>nacl000016fe</alternate_id>
        <comment>PDS3 SOURCE_PRODUCT_ID</comment>
      </Alias>
    </Alias_List>
    <Modification_History>
      <Modification_Detail>
        <modification_date>2023-09-06</modification_date>
        <version_id>2.0</version_id>
        <description>
          Updated PDS4 label
        </description>
      </Modification_Detail>
      <Modification_Detail>
        <modification_date>2022-10-31</modification_date>
        <version_id>1.0</version_id>
        <description>
          This PDS4 labeled (detached label) product (orig PDS3 image) is a result
          of development activity for eventual LUNAR RECONNAISSANCE ORBITER CAMERA NAC␣
↪EDR migration to PDS4.
        </description>
      </Modification_Detail>
    </Modification_History>
  </Identification_Area>
  <Observation_Area>
    <Time_Coordinates>
      <start_date_time>2009-07-19T00:00:26.423000Z</start_date_time>
      <stop_date_time>2009-07-19T00:01:17.707000Z</stop_date_time>
    </Time_Coordinates>
    <Primary_Result_Summary>
      <purpose>Science</purpose>
      <processing_level>Partially Processed</processing_level>
      <description>The Lunar Reconnaissance Orbiter Camera (LROC) Wide Angle Camera␣
↪(WAC) and Narrow Angle Cameras (NACs)
        are on the NASA Lunar Reconnaissance Orbiter (LRO). The WAC is a 7-color push-
↪frame camera (100 and 400 m/pixel
        visible and UV, respectively), while the two NACs are monochrome narrow-angle␣
↪linescan imagers (0.5 m/pixel).
        The primary mission of LRO is to obtain measurements of the Moon that will␣
↪enable future lunar human exploration.
        The overarching goals of the LROC investigation include landing site␣
↪identification and certification, mapping
        of permanently polar shadowed and sunlit regions, meter-scale mapping of polar␣
↪regions, global multispectral
        imaging, a global morphology base map, characterization of regolith properties,␣
↪and determination of current
        impact hazards.
```

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```
      </description>
    </Primary_Result_Summary>
    <Investigation_Area>
      <name>LUNAR RECONNAISSANCE ORBITER</name>
      <type>Mission</type>
      <Internal_Reference>
        <lid_reference>urn:nasa:pds:context:investigation:mission.lunar_reconnaissance_
↪orbiter</lid_reference>
        <reference_type>data_to_investigation</reference_type>
        <comment>This is the PDS4 logical identifier for LRO</comment>
      </Internal_Reference>
    </Investigation_Area>
    <Observing_System>
      <Observing_System_Component>
        <name>LUNAR RECONNAISSANCE ORBITER</name>
        <type>Host</type>
        <Internal_Reference>
          <lid_reference>urn:nasa:pds:context:instrument_host:spacecraft.lro</lid_
↪reference>
          <reference_type>is_instrument_host</reference_type>
        </Internal_Reference>
      </Observing_System_Component>
      <Observing_System_Component>
        <name>LUNAR RECONNAISSANCE ORBITER CAMERA</name>
        <type>Instrument</type>
        <Internal_Reference>
          <lid_reference>urn:nasa:pds:context:instrument:lro.lroc</lid_reference>
          <reference_type>is_instrument</reference_type>
        </Internal_Reference>
      </Observing_System_Component>
    </Observing_System>
    <Target_Identification>
      <name>MOON</name>
      <type>Satellite</type>
      <Internal_Reference>
        <lid_reference>urn:nasa:pds:context:target:satellite.earth.moon</lid_reference>
        <reference_type>data_to_target</reference_type>
      </Internal_Reference>
    </Target_Identification>
    <Mission_Area>
      <lro:LRO_Parameters>
        <!-- parameters for all LRO products -->
        <lro:product_type>EDR</lro:product_type>
        <lro:product_version_id>v1.8</lro:product_version_id>
        <lro:orbit_number>294</lro:orbit_number>
        <lro:mission_phase_name>COMMISSIONING</lro:mission_phase_name>
        <lro:spacecraft_clock_start_count>1/269654426:25923</lro:spacecraft_clock_start_
↪count>
        <lro:spacecraft_clock_stop_count>1/269654477:44530</lro:spacecraft_clock_stop_
↪count>
        <lro:producer_institution_name>Arizona State University</lro:producer_
↪institution_name>
```

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```
      <lro:LROC_Parameters>
        <!-- Parameters specific to LROC -->
        <lro:upload_id>SC_2009200_0000_B_V01.txt</lro:upload_id>
        <lro:rationale_desc>TARGET OF OPPORTUNITY</lro:rationale_desc>
        <lro:data_quality_id>0</lro:data_quality_id>
        <lro:data_quality_desc>
          The DATA_QUALITY_ID is set to an 8-bit value that encodes the following data␣
↪quality information
          for the observation. For each bit  a value of 0 means FALSE and a value of 1␣
↪means TRUE. More
          information about the data quality ID can be found in the LROC EDR/CDR SIS,␣
↪section 3.3 'Label
          and Header Descriptions'. Bit 1: Temperature of focal plane array is out of␣
↪bounds. Bit 2:
          Threshold for saturated pixels is reached. Bit 3: Threshold for under-
↪saturated pixels is
          reached. Bit 4: Observation is missing telemetry packets. Bit 5: SPICE␣
↪information is bad or
          missing. Bit 6: Observation or housekeeping information is bad or missing.␣
↪Bit 7: Spare.
          Bit 8: Spare.
        </lro:data_quality_desc>
        <!-- NAC specific attributes -->
        <lro:preroll_time>2009-07-19T00:00:25.417000Z</lro:preroll_time>
        <lro:spacecraft_clock_preroll_count>1/269654425:25559</lro:spacecraft_clock_
↪preroll_count>
        <lro:frame_id>LEFT</lro:frame_id>
        <!-- NAC environment attributes -->
        <lro:temperature_scs unit="degC">2.8498010635375977</lro:temperature_scs>
        <lro:temperature_fpa unit="degC">17.86085319519043</lro:temperature_fpa>
        <lro:temperature_fpga unit="degC">-10.170159339904785</lro:temperature_fpga>
        <lro:temperature_telescope unit="degC">6.049563884735107</lro:temperature_
↪telescope>
        <lro:temperature_scs_raw>2817</lro:temperature_scs_raw>
        <lro:temperature_fpa_raw>2109</lro:temperature_fpa_raw>
        <lro:temperature_fpga_raw>3346</lro:temperature_fpga_raw>
        <lro:temperature_telescope_raw>2670</lro:temperature_telescope_raw>
        <!-- NAC imaging attributes -->
        <lro:line_exposure_duration unit="ms">0.9776000000000001</lro:line_exposure_
↪duration>
        <lro:line_exposure_code>75</lro:line_exposure_code>
        <lro:dac_reset_level>198</lro:dac_reset_level>
        <lro:channel_a_offset>43</lro:channel_a_offset>
        <lro:channel_b_offset>108</lro:channel_b_offset>
        <lro:compand_code>0</lro:compand_code>
        <lro:line_code>51</lro:line_code>
        <lro:bterm1>0</lro:bterm1>
        <lro:bterm2>8</lro:bterm2>
        <lro:bterm3>25</lro:bterm3>
        <lro:bterm4>59</lro:bterm4>
        <lro:bterm5>128</lro:bterm5>
        <lro:mterm1>0.5</lro:mterm1>
```

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```
          <lro:mterm2>0.25</lro:mterm2>
          <lro:mterm3>0.125</lro:mterm3>
          <lro:mterm4>0.0625</lro:mterm4>
          <lro:mterm5>0.03125</lro:mterm5>
          <lro:xterm1>0</lro:xterm1>
          <lro:xterm2>32</lro:xterm2>
          <lro:xterm3>136</lro:xterm3>
          <lro:xterm4>543</lro:xterm4>
          <lro:xterm5>2207</lro:xterm5>
          <lro:compression_flag>1</lro:compression_flag>
          <lro:mode>7</lro:mode>
        </lro:LROC_Parameters>
      </lro:LRO_Parameters>
    </Mission_Area>
    <Discipline_Area>
      <img:Imaging>
        <Local_Internal_Reference>
          <local_identifier_reference>DATA_FILE</local_identifier_reference>
          <local_reference_type>imaging_parameters_to_image_object</local_reference_type>
        </Local_Internal_Reference>
        <img:Optical_Filter>
          <img:bandwidth unit="nm">300</img:bandwidth>
          <img:center_filter_wavelength unit="nm">600</img:center_filter_wavelength>
        </img:Optical_Filter>
        <img:Sampling>
          <img:crosstrack_summing>1</img:crosstrack_summing>
        </img:Sampling>
      </img:Imaging>
      <disp:Display_Settings>
        <Local_Internal_Reference>
          <local_identifier_reference>Array_2D_Image</local_identifier_reference>
          <local_reference_type>display_settings_to_array</local_reference_type>
        </Local_Internal_Reference>
        <disp:Display_Direction>
          <disp:horizontal_display_axis>Sample</disp:horizontal_display_axis>
          <disp:horizontal_display_direction>Left to Right</disp:horizontal_display_
↪direction>
          <disp:vertical_display_axis>Line</disp:vertical_display_axis>
          <disp:vertical_display_direction>Top to Bottom</disp:vertical_display_
↪direction>
        </disp:Display_Direction>
      </disp:Display_Settings>
    </Discipline_Area>
  </Observation_Area>
  <Reference_List>
    <External_Reference>
      <doi>10.1007/s11214-010-9634-2</doi>
      <reference_text>Robinson, M. S.; Brylow, S. M.; Tschimmel, M.; Humm, D.; Lawrence,␣
↪S. J.; Thomas, P. C.;
        Denevi, B. W.; Bowman-Cisneros, E.; Zerr, J.; Ravine, M. A.; Caplinger, M. A.;␣
↪Ghaemi, F. T.; Schaffner, J. A.;
        Malin, M. C.; Mahanti, P.; Bartels, A.; Anderson, J.; Tran, T. N.; Eliason, E. M.
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```
↪; McEwen, A. S. Turtle, E.;
        Jolliff, B. L.; Hiesinger, H., 2010, "Lunar Reconnaissance Orbiter Camera (LROC)␣
↪Instrument Overview", Space
        Science Reviews, Volume 150, Issue 1-4, pp. 81-124
      </reference_text>
      <description>instrument overview</description>
    </External_Reference>
  </Reference_List>
  <File_Area_Observational>
    <File>
      <file_name>M102600893LE.IMG</file_name>
      <local_identifier>DATA_FILE</local_identifier>
      <creation_date_time>2013-09-10T16:46:24.000000Z</creation_date_time>
      <file_size unit="byte">264467400</file_size>
      <md5_checksum>7cf30c67d8f064a38222aea813613547</md5_checksum>
      <comment>Lunar Reconnaissance Orbiter Camera NAC EDR Product</comment>
    </File>
    <Header>
      <offset unit="byte">0</offset>
      <object_length unit="byte">5064</object_length>
      <parsing_standard_id>PDS3</parsing_standard_id>
      <description>PDS3 attached header</description>
    </Header>
    <Array_2D_Image>
      <local_identifier>Array_2D_Image</local_identifier>
      <offset unit="byte">5064</offset>
      <axes>2</axes>
      <axis_index_order>Last Index Fastest</axis_index_order>
      <Element_Array>
        <data_type>UnsignedByte</data_type>
        <unit>RAW_INSTRUMENT_COUNT</unit>
      </Element_Array>
      <Axis_Array>
        <axis_name>Line</axis_name>
        <elements>52224</elements>
        <sequence_number>1</sequence_number>
      </Axis_Array>
      <Axis_Array>
        <axis_name>Sample</axis_name>
        <elements>5064</elements>
        <sequence_number>2</sequence_number>
      </Axis_Array>
    </Array_2D_Image>
  </File_Area_Observational>
</Product_Observational>
```