



LARGE SYNOPTIC SURVEY TELESCOPE

Large Synoptic Survey Telescope (LSST)

Data Management - LSST Raw Image Archiving Service Test Specification

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LDM-538

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Abstract

This document describes the detailed test specification for the Data Management - LSST Raw Image Archiving Service. This is a specific DM test, and will grow as more tests are needed for the entire environment. This includes two individual tests for the overall raw image creation and ingest into the permanent record of the survey.

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Data Management - LSST Raw Image Archiving Service Test Specification

1 Introduction

This document specifies the test procedure for the Data Management - LSST Raw Image Archiving Service.

The Data Management - LSST Raw Image Archiving Service is the component of the LSST system which is responsible for:

- The creation of a well-formed raw image;
- Providing fast access to the raw image by the Observatory Operations staff;
- Saving the raw image into the permanent record of the survey;

A full description of this service is provided in §5.1.1 of LDM-148 and §2.2 (which describes LSSTCam Archiving Service), §2.3 (Spectrograph Archiving Service) and §2.6 (Observatory Operations Data Service) of LDM-230.

1.1 Objectives

This document builds on the description of LSST Data Management's approach to testing as described in LDM-503 to describe the detailed tests that will be performed on the Data Management - LSST Raw Image Archiving Service as part of the verification of the DM system.

It identifies test designs, test cases and procedures for the tests, and the pass/fail criteria for each test.

1.2 Definitions, Acronyms, and Abbreviations

Acronym	Description
CCS	Camera Control System

DAQ	Data Acquisition
OODS	Observatory ?? Data System
DBB	Data Backbone
DMHS	Data Management Header Service
DR	Disaster Recovery
L1	Level One Image Ingest and Data Distribution Environment
NCSA	National Center for Supercomputing
OODS	Observatory Operations Data Service
OCS	Observatory Control System

1.3 Scope

This document describes the test procedures for the Raw Image Archiving Service which includes parts from each of the following components of the LSST system (as described in LDM-148):

- OCS
- Camera DAQ)
- DM Header Service
- L1 Archiver
- EFD Large File Annex
- DM OCS Bridge
- DMCS
- Archiver
- Catch-up Archiver
- Alert Processor
- ATS achiver
- Data Forwarders

- Observatory Operations Data Service
- Data Backbone Services

1.4 Applicable Documents

LSE-209	Software Component to Observatory Control System (OCS) Interface
LSE-68	Camera Data Acquisition Interface
LSE-70	System Communication Protocol Interface
LSE-72	Data Management - OCS Software Communication Interface
LDM-148	LSST DM System Architecture
LDM-294	LSST DM Organization & Management
LDM-503	LSST DM Test Plan
LSE-61	LSST DM Subsystem Requirements
LSE-163	LSST Data Products Definition Document
LSE-29	LSST Data Products Definition Document

1.5 References

- [1] **[LSE-29]**, Claver, C.F., The LSST Systems Engineering Integrated Project Team, 2017, *LSST System Requirements (LSR)*, LSE-29, URL <https://ls.st/LSE-29>
- [2] **[LSE-68]**, Dubois-Felsmann, G., 2015, *Camera Data Acquisition Interface*, LSE-68, URL <https://ls.st/LSE-68>
- [3] **[LSE-61]**, Dubois-Felsmann, G., Jenness, T., 2017, *LSST Data Management Subsystem Requirements*, LSE-61, URL <https://ls.st/LSE-61>
- [4] **[LSE-72]**, Dubois-Felsmann, G., Schumacher, G., Selvy, B., 2014, *OCS Command Dictionary for Data Management*, LSE-72, URL <https://ls.st/LSE-72>
- [5] **[LSE-163]**, Jurić, M., et al., 2017, *LSST Data Products Definition Document*, LSE-163, URL <https://ls.st/LSE-163>
- [6] **[LDM-148]**, Lim, K.T., Bosch, J., Dubois-Felsmann, G., et al., 2017, *Data Management System Design*, LDM-148, URL <https://ls.st/LDM-148>

- [7] **[LSE-209]**, Lotz, P., 2016, *Software Component to OCS Interface*, LSE-209, URL <https://ls.st/LSE-209>
- [8] **[LSE-70]**, Lotz, P., 2016, *System Communication Protocol Interface*, LSE-70, URL <https://ls.st/LSE-70>
- [9] **[LDM-503]**, O'Mullane, W., Jurić, M., Economou, F., 2017, *Data Management Test Plan*, LDM-503, URL <https://ls.st/LDM-503>
- [10] **[LDM-294]**, O'Mullane, W., Swinbank, J., Jurić, M., DMLT, 2017, *Data Management Organization and Management*, LDM-294, URL <https://ls.st/LDM-294>
- [11] **[LDM-230]**, Petravick, D., Gelman, M., 2017, *Concept of Operations for the LSST Data Facility Services*, LDM-230, URL <https://ls.st/LDM-230>

2 Approach

The major activities to be performed are to:

- Show successful integration between Telescope subsystems and L1 Archiver service;
- Show successful integration between L1 Archiver and OODS;
- Show successful integration between L1 Archiver and DBB;

2.1 Tasks and criteria

The following are the major items under test:

- Create a well-formed raw image with data acquired from the Camera DAQ and the DM Header Service;
- Save a raw image, with matching L1 checksum, in the OODS cache and access it using normal LSST mechanisms (e.g., "Data Butler");
- Ingest a raw image, with matching L1 checksum, into the DBB;

2.2 Features to be tested

Do the following satisfy the requirements described in LSE-61?

- Proper fetch and reassembly of image data from camera DAQ;
- Proper merge of header service data with image data;
- Correct insertion of exposure specific data needed in the data file that is not supplied by header service;
- Confirmation that the data files arrive at their destination intact;
- Raw data access;
- Archiving of raw images;

2.3 Features not to be tested

This document describes the end-to-end testing of various components that comprise the service. It does not include tests internal to a single component. Also this test specification does not extend beyond the positive pass/fail options. It does not take into account a failure of a component and how the subsystem should recover from those failures.

2.4 Pass/fail criteria

The results of all tests will be assessed using the criteria described in LDM-503 §4.

2.5 Suspension criteria and resumption requirements

Refer to individual test cases where applicable.

3 Test Specification Design

3.1 RAS-00: Raw Image Archive Service

3.1.1 Objective

This test specification demonstrates the successful writing of a well-formed raw image to the permanent record of the survey and for rapid access for Observatory Operations staff.

3.1.2 Test case identification

Test Case	Description
RAS-00-00	Tests that well-formed raw image can be written
RAS-00-10	Tests that the raw image can be accessed via the OODS
RAS-00-20	Tests that the raw image has been archived in the DBB

4 Test Case Specification

4.1 RAS-00-00: Writing well-formed raw image

4.1.1 Requirements

- ;
- Data must be fetched and reassembled correctly, regardless of CCD/Sensor manufacturer type (two different types will be used);
- The base unit of data to be saved is by the amplifier segments of each CCD/sensor;
- After Fits files are built but before they are sent to an archive location, their checksum should be computed,;
- Files are verified after being moved to an archive using the checksum value;
- Upon shutdown, the L1 Image Ingest and Distribution system should issue a report stating which data (by Image-ID) was processed and whether it was successfully handed off to archive services,;

4.1.2 Test items

This test will check:

- The successful integration of the Pathfinder components with the DM Header Service and the L1 Archiver;
- That the raw images are well-formed and meet specifications in change-controlled documents LSE-61 and TBD.

4.1.3 Intercase dependencies

- None

4.1.4 Environmental needs

4.1.4.1 Hardware

- L1 test stand
- Test machine for monitoring services

4.1.4.2 Software

- L1 software and services needed to create raw image
- A SAL message Emulator to represent needed messages from other LSST subsystems
- Monitoring Service and plugins specific to monitoring L1 Test Stand and services

4.1.5 Input specification

None

4.1.6 Output specification

- Raw image(s) that follow specifications defined in change-controlled document TBD.

4.1.7 Procedure

- Configure system to pull appropriate data from the DAQ emulator
- Acquire system to create raw image from DAQ readout and DMHS
- Check raw image against specifications and expected checksum

4.2 RAS-00-10: Raw images in Observatory Operations Data Service

4.2.1 Requirements

Requirements for the OODS

- the handoff of the data;
- that the data is be accessible;

4.2.2 Test items

This test will check:

- The handoff of a raw image from the L1 Archiver to the OODS cache manager is successful
- A recently taken raw image is accessible to the Observatory Operations staff at the base and summit

4.2.3 Intercase dependencies

- RAS-00-00

4.2.4 Environmental needs

4.2.4.1 Hardware To complete all tests in a manner which reflects the real system, the following hardware is needed. Note: If not testing inter-machine access, the hardware can be

minimized to a single machine outside of the L1 Test Stand.

- L1 Test Stand (include hardware from RAS-00-00) + read/write access to OODS cache disk
- Test Machine for OODS cache manager with read/write access to OODS cache disk
- Test machine for Observatory Operations staff at "base" that can access OODS cache disk
- Test machine for Observatory Operations staff at "summit" that can access OODS cache disk
- Test machine for monitoring services

Size of cache disk is determined by number of files to be included in the test.

4.2.4.2 Software The following software must be installed:

- L1 Test Stand (include software from RAS-00-00)
- OODS cache manager
- Monitoring Service and plugins specific to monitoring raw images and OODS
- LSST stack for checking raw images

4.2.5 Input specification

None.

4.2.6 Output specification

- Raw image(s) that follow format defined in change-controlled document TBD.
- Database (may be sqlite file) that enables the raw image(s) to be accessed via a "Data Butler".

4.2.7 Procedure

- Initialize all services configuring the L1 Archiver so that the raw images are to be archived
- Acquire an image. After the raw image finishes its route through the components, it will automatically be in the Test Data Backbone.
- For each of the expected raw images, verify that the checksum matches the original L1 checksum.
- The DM Stack shall be initialized using the loadLSST script
- A “Data Butler” will be initialized to access the raw image repository in the OODS cache.
- For each of the expected raw images, the file will be retrieved from the “Data Butler” and verified to meet the raw image requirements (correctness and completeness of format, metadata and image data) as specified in change-controlled document (TBD)
- Check that monitoring showed the appropriate information successfully.

4.3 RAS-00-20: Raw images are part of permanent record of survey via DBB

4.3.1 Requirements

- LSR-REQ-0047
- LSR-REQ-0048

4.3.2 Test items

This test will check:

- That the handoff of a raw image from the L1 Archiver to the DBB buffer manager is successful
- That the raw image is ingested into the Data Backbone successfully
- That the monitoring of the above items is successful

Note: For a complete check of the various aspects of what it means for a raw image to be in the Data Backbone, see the tests for the Data Backbone (doc TBD)

4.3.3 Intercase dependencies

- RAS-00-00

4.3.4 Environmental needs

4.3.4.1 Hardware

- L1 Test Stand (include hardware from RAS-00-00) + read/write access to DBB buffer disk
- Test Machine for DBB buffer manager with read/write access to DBB buffer disk
- Test machine for each DBB endpoint with read/write access to DBB disk
- Test machine for monitoring service

Size of buffer disk and DBB disk is determined by number of files to be included in the test.

Note: If not testing inter-machine operability, then the hardware can be minimized to a single machine outside of the L1 test stand.

4.3.4.2 Software

- L1 Test Stand
- DBB buffer manager
- DBB raw image ingestion
- DBB database
- Monitoring Service and plugins specific to monitoring raw images, DBB buffer manager, and DBB

4.3.5 Input specification

None

4.3.6 Output specification

- Raw image(s) are saved to storage and replicated to correct locations with checksums that match original L1 checksum.
- Database containing information of the following types: physical, location, science meta-data, provenance as specified in change control document (TBD).
- Both image(s) and database entries replicated correctly.

4.3.7 Procedure

- Initialize all services configuring the L1 Archiver so that the raw images are to be archived.
- Acquire an image to be taken. After the raw image finishes its route through the components, it will automatically be in the Test Data Backbone.
- Check that the raw image is accessible at each test DBB endpoint and matches original L1 checksum.
- Check that monitoring showed the appropriate information successfully.
- More complete tests of the DBB can be done by running the DBB service tests on the raw image(s). These would check correctness and completeness of the data stored in the database as well as checking that the file has been replicated to all required places.