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Data Management

LSST Level 2 System Test Specification

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LDM-534

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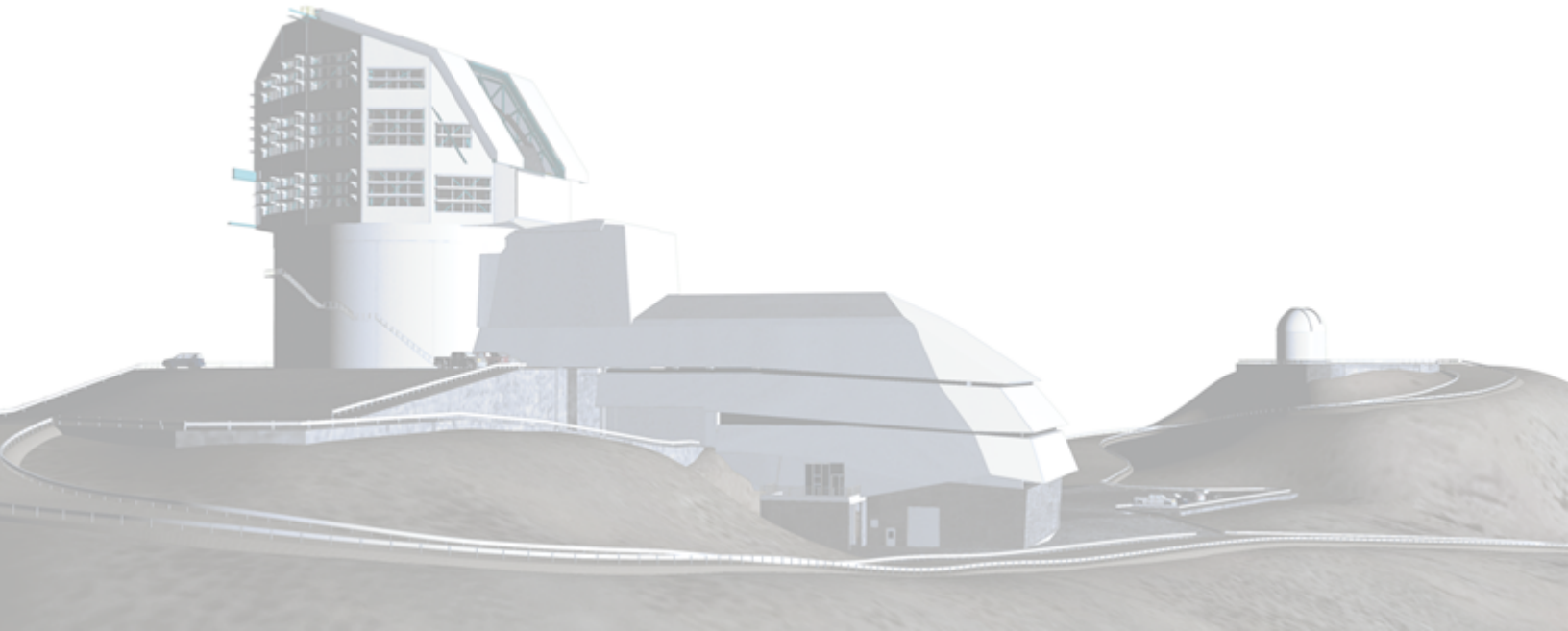

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Abstract

This document describes the detailed test specification for the LSST Level 2 System.

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Change Record

Version	Date	Description	Owner name
1.0	2017-06-30	Initial release of draft version.	Swinbank
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3.0	2018-01-11	Updated to cover the LDM-503-2 (“HSC Reprocessing”) milestone.	Bosch, Chiang, Gower, Swinbank
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Contents

LSST Level 2 System Test Specification

1 Introduction

This document specifies the test procedure for the LSST Level 2 System.

The LSST Level 2 System is the component of the LSST system which is responsible for scientific processing leading to:

- Annual data release production;
- Periodic (re-) generation of calibration products;
- Periodic (re-) generation of templates for generating difference images, to be consumed in the L1 system;
- Generating QC metrics based on pipeline execution and post-processing of scientific data products.

A full description of this product is provided in §§7 (which describes the Data Facility provided execution services) and 13.1 (the science payloads) of LDM-148.

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 LSST Level 2 System 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 Scope

This document describes the test procedures for the following components of the LSST system (as described in LDM-148):

- Services provided by the LSST Data Facility:
  - Template and Calibration Products Production Execution
  - Data Release Production Execution
  - Level 2 Quality Control
- Science payloads:
  - Annual Calibration Products Production Payload
  - Data Release Production Payload
  - Periodic Calibration Products Production Payload
  - Template Generation Payload

1.3 Applicable Documents

LDM-148	LSST DM System Architecture
LDM-151	LSST DM Science Pipelines Design
LDM-294	LSST DM Organization & Management
LDM-502	The Measurement and Verification of DM Key Performance Metrics
LDM-503	LSST DM Test Plan
LSE-61	LSST DM Subsystem Requirements
LSE-163	LSST Data Products Definition Document
LSE-180	Level 2 Photometric Calibration for the LSST Survey

1.4 References

[1] **[DMTR-31]**, Chiang, H.F., Daues, G., Thrush, S., The NCSA Team, 2017, *S17B HSC PDR1 Reprocessing Report*, DMTR-31, URL https://ls.st/DMTR-31

[2] **[LSE-61]**, Dubois-Felsmann, G., Jenness, T., 2018, *LSST Data Management Subsystem Requirements*, LSE-61, URL https://ls.st/LSE-61

[3] **[LDM-639]**, Guy, L., 2018, *DM Acceptance Test Specification*, LDM-639, URL https://ls.st/LDM-639

[4] **[LPM-17]**, Ivezić, Ž., The LSST Science Collaboration, 2018, *LSST Science Requirements Document*, LPM-17, URL https://ls.st/LPM-17

[5] **[LSE-180]**, Jones, L., 2013, *Level 2 Photometric Calibration for the LSST Survey*, LSE-180, URL https://ls.st/LSE-180

[6] **[LSE-163]**, Jurić, M., et al., 2017, *LSST Data Products Definition Document*, LSE-163, URL https://ls.st/LSE-163

[7] **[LDM-148]**, Lim, K.T., Bosch, J., Dubois-Felsmann, G., et al., 2018, *Data Management System Design*, LDM-148, URL https://ls.st/LDM-148

[8] **[LDM-502]**, Nidever, D., Economou, F., 2016, *The Measurement and Verification of DM Key Performance Metrics*, LDM-502, URL https://ls.st/LDM-502

[9] **[LDM-294]**, O'Mullane, W., Swinbank, J., Jurić, M., DMLT, 2018, *Data Management Organization and Management*, LDM-294, URL https://ls.st/LDM-294

[10] **[LDM-503]**, O'Mullane, W., Swinbank, J., Jurić, M., Economou, F., 2018, *Data Management Test Plan*, LDM-503, URL https://ls.st/LDM-503

[11] **[LDM-151]**, Swinbank, J.D., et al., 2017, *Data Management Science Pipelines Design*, LDM-151, URL https://ls.st/LDM-151

[12] **[LSE-63]**, Tyson, T., DQA Team, Science Collaboration, 2017, *Data quality Assurance Plan: Requirements for the LSST Data Quality Assessment Framework*, LSE-63, URL https://ls.st/LSE-63

2 Approach

The major activities to be performed are to:

- Compare the design of the Data Release Production payload as implemented to the requirements on the outputs of the DM Subsystem as defined in LSE-63 and LSE-163 to demonstrate that all data products required by the scientific community will be delivered by the system as built.

- Ensure that all data products included in the DRP payload design are correctly produced and persisted appropriately to the LSST Data Backbone when executing a data release production.
- Compare the design of the Calibration Products payloads as implemented to the requirements laid down in LSE-63, the overall design described in LSE-180 and the inputs of the scientific pipeline payloads as described in LDM-151.
- Ensure that all data products included in the CPP payload design are correctly produced and persisted appropriately to the LSST Data Backbone and/or Calibration Database when executing a calibration products production.
- Compare the implementation of the Template Generation payloads to the inputs required by the Alert Production payload as defined in LDM-151.
- Ensure that all data products required by the L1 system are correctly produced and persisted appropriately to the LSST Data Backbone when executing a template generation production.
- Demonstrate that QC metrics are properly calculated and transmitted during the execution all L2 production types.
- Demonstrate that post-processing QC analysis of data products can be used to identify and report on failures or anomalies in the processing.

2.1 Tasks and criteria

The following are the major items under test:

- The science payload capable of generating all LSST annual data products;
- Calibration products payloads, run at a variety of cadences, to generate calibration products required in the generation of LSST nightly and annual data products;
- The template generation payload capable of generating deep templates required for difference imaging in the context of both nightly and annual processing.
- Services capable of scheduling and managing the execution of all of the above payloads, marshalling their results, and making them available to other parts of the system for analysis or further distribution.

2.2 Features to be tested

- Execution of payloads described in §2.1;
- Persistence of all required data products;
- Scientific fidelity of those data products: do they satisfy the requirements described in LSE-61?

2.3 Features not to be tested

This document does not describe facilities for periodically generating or collecting key performance metrics (KPMs), except insofar as those KPMs are incidentally measured as part of executing the documented testcases. The KPMs and the system being used to track KPMs and to ensure compliance with documented requirements is described in LDM-502.

2.4 Pass/fail criteria

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

Note that, when executing pipelines, tasks or individual algorithms, any unexplained or unexpected errors or warnings appearing in the associated log or on screen output must be described in the documentation for the system under test. Any warning or error for which this is not the case must be filed as a software problem report and filed with the DMCCB.

2.5 Suspension criteria and resumption requirements

Refer to individual test cases where applicable.

2.6 Naming convention

All tests are named according to the pattern PROD-XX-YY where:

prodThe product under test. Relevant entries for this document are:

DRP The Data Release Production payload and associated service

CPP The Calibration Products Production payload and associated services

TMP The Template Generation payload and associated service

xx Test specification number (in increments of 10)

yy Test case number (in increments of 5)

3 Test Specification Design

3.1 DRP-00: Small Scale Data Release Processing

3.1.1 Objective

This test specification demonstrates the successful execution of a Data Release Production payload on a relatively small scale based on data from precursor surveys.

It will demonstrate that:

- Science payload code can be made available on systems managed by the LSST Data Facility;
- The Data Release Production science payload can be executed under the control of the Data Release Production Execution service;
- All required science data products can be collected by the execution service and made available for subsequent analysis;
- The Data Release Production payload generates results broadly equivalent to “native” reductions of precursor survey data.

Note that this test specification does not extend to demonstrating the detailed compliance of LSST data products with all Science Requirements Document level requirements: such a demonstration would require carefully curated LSST-like datasets (or simulated data), a detailed understanding of the LSST system, LSST-like calibration products, etc, which are assumed not to be available for this test.

3.1.2 Approach refinements

The general approach defined in LDM-503 is used.

3.1.3 Test case identification

Test Case	Description
DRP-00-00	Tests that the Data Release Production science payload can be installed on LSST Data Facility-managed systems.
DRP-00-05	Tests the execution of the Data Release Production payload under the control of the Data Release Production Execution Service.
DRP-00-10	Tests that required data products are produced by executing the Data Release Production payload.
DRP-00-15	Tests that the delivered source catalog meets scientific requirements.
DRP-00-25	Tests that the delivered object catalog meets scientific requirements.
DRP-00-30	Tests that the delivered processed visit images meet scientific requirements.
DRP-00-35	Tests that the delivered coadded images meet scientific requirements.

4 Test Case Specification

4.1 DRP-00-00: Installation of the Data Release Production science payload.

4.1.1 Requirements

DMS-REQ-0308.

4.1.2 Test items

This test will check:

- That the Data Release Production science payload is available for distribution from documented channels;
- That the Data Release Production science payload can be installed on LSST Data Facility-managed systems.

4.1.3 Intercase dependencies

None.

4.1.4 Environmental needs

4.1.4.1 Hardware This test case shall be executed on a developer system at the LSST Data Facility which serves as the "head node" or otherwise provides access to filesystems shared by the LSST Verification Cluster (LSST-VC). We assume that this system will be `lsst-dev01.ncsa.illinois.edu` and the filesystem will be a GPFS-based system mounted at `/software`.

The test also requires access to one LSST-VC compute node.

4.1.4.2 Software All prerequisite packages listed at `https://pipelines.lsst.io/install/prereqs/centos.html` must be available on the test system and on the LSST-VC compute node.

4.1.5 Input specification

No input data is required for this test case.

4.1.6 Output specification

The Data Release Production science payload will be made available on a shared filesystem accessible from LSST-VC compute notes.

4.1.7 Procedure

1. Release 14.0 of the LSST Science Pipelines will be installed into the GPFS filesystem accessible at `/software` on `lsst-dev01` following the instructions at `https://pipelines.lsst.io/install/newinstall.html`.
2. The lsst_distrib top level package will be enabled:

```
source /software/lsstsw/stack3/loadLSST.bash
setup lsst_distrib
```

3. The "LSST Stack Demo" package will be downloaded onto the test system from `https://github.com/lsst/lsst_dm_stack_demo/releases/tag/14.0` and uncompressed.
4. The demo package will be executed by following the instructions in its "README" file. The string "Ok." should be returned.
5. A shell on an LSST-VC compute node will now be obtained by executing:

```
$ srun -I --pty bash
```

6. The demo package will be executed on the compute node and the same result obtained.

4.2 DRP-00-05: Execution of the DRP Science Payload by the Batch Production Service

4.2.1 Requirements

For LDM-503-2 the test is limited to: DMS-REQ-0106,DMS-REQ-0293,DMS-REQ-0302,DMS-REQ-0303.

4.2.2 Test items

This test will check that the DRP Science Payload can be executed using a specific version of the Batch Production Service provided by the LSST Data Facility. Since the outputs are stored in the Data Backbone, it too is a component of this test.

4.2.3 Intercase dependencies

- DRP-00-00

4.2.4 Environmental needs

4.2.4.1 Hardware This test case shall be executed on a testbed at the LSST Data Facility.

For LDM-503-2, this testbed includes:

- LSST Verification Cluster (LSST-VC) with Slurm Job Scheduler
- Submit and compute nodes with read/write access to various GPFS shared filesystems:
  1. Filesystem containing the software stack
  2. Filesystem for the submit side temporary outputs
  3. Filesystem being used by the prototype Data Backbone. (This means that the framework can use a cp transfer protocol between the job and the Data Backbone and does not require additional transfer services to be running.)
  4. Filesystem for the individual job scratch directories.
- Single node Oracle database (version 12c)
- Submit node (lsst-dev01.ncsa.illinois.edu) running the HTCondor Central Manager (version 8.7.3).

4.2.4.2 Software All the necessary software will be pre-installed. The software includes the science pipeline codes as well as the Data Management system codes (Batch Processing Service, Data Backbone).

For LDM-503-2, Python 2 versions of software will be used. The science pipeline codes will be provided via the LSST DM Software Stack, release 14.0. The Batch Processing Service and the Data Backbone are initial versions using the DESDM Framework packages. LSST-specific plugins as well as DRP pipeline integration codes are also pre-installed. All python DESDM Framework packages, plugins and integration codes exist in the lsst-dm github with tag 1.01.

The DESDM prerequisites come from the official DESDM eups package firstcut Y4N+5. They are installed using DESDM's eups install process.

The ticket branch `tickets/DM-12291` of the LSST Software Stack packages `meas_base`, `pipe_tasks`, and `obs_subaru` will be used to change the patch ID naming convention. This is due to issues of having commas in the filenames and data IDs, as discussed in RFC-361; the solution has been agreed in RFC-365 for future implementation in DM-11874, DM-11875, and DM-11876.

For LDM-503-2, the software will be installed into the GPFS space at `/project/production/` on LSST-VC. A single eups prototype package will be defined to encompass the above mentioned software.

4.2.5 Input specification

A small number of selected tracts of the Hyper Suprime-Cam dataset will be used along with appropriate calibration datasets.

For LDM-503-2, the three tracts of the Hyper Suprime-Cam "RC1" dataset, as defined Appendix A.1.1, will be used. The calibration dataset will be the 20170105 version, defined as per DMTR-31. Raw files known to fail processCcd will be blacklisted.

4.2.6 Output specification

The output data products will be available from the Data Backbone.

For LDM-503-2, the output data products will be available on the LSST-VC via a shared filesystem and advanced data discovery is done via SQL queries against the Oracle database.

4.2.7 Test configuration

For each test, the science configuration and operations configuration of the pipeline must be specified.

4.2.7.1 Science configuration

1. What pipeline steps are to be executed?

   (a) For LDM-503-2 test, the following pipeline steps will be executed:

   - `processCcd`
   - `makeCoaddTempExp`
   - `assembleCoadd`
   - `detectCoaddSources`
   - `mergeCoaddDetections`
   - `measureCoaddSources`
   - `mergeCoaddMeasurements`
   - `forcedPhotCoadd`

2. What metadata needs to be saved for each data product type §4.3.2?

   - For LDM-503-2 test, basic metadata such are visit, ccd, patch, tract, filter are required as appropriate for each data product type. Future milestones will expand this to include other science values.

3. Any non-default task configuration to be used?
   For LDM-503-2 test, use the HSC default configs from the stack, including the task defaults and `obs_subaru`'s overrides, except:

   - Since not running `MosaicTask`, set `doApplyUberCal=False` for `makeCoaddTempExp.py` and `assembleCoadd.py`.
   - In `makeCoaddTempExp.py` and `assembleCoadd.py`, retarget the `select` subtask to `PsfWcsSelectImagesTa` similar to `coaddDriver.py` in `pipe_drivers`.

4.2.7.2 Operations configuration

1. Any special Batch Processing Service configuration to be used?
   For LDM-503-2 test,

   (a) Each tract will be executed on its own set of nodes (obtained using allocateNodes.py) as opposed to a single larger set of nodes shared by all tracts.

4.2.8 Procedure

Executing a pipeline successfully through the Batch Processing Serivce means that the processing attempt passed basic data completeness and integrity checks (§4.2.8.3).

4.2.8.1 Setup

1. The LSST Science Pipelines and the DESDM Framework, plugins, and integration codes as described in §4.2.4.2 have already been installed. The Operator merely sets up the expanded stack using eups.
2. Input raw and calibration data must exist in the Data Backbone. If not, the data will be ingested into Data Backbone.
3. The operator tags and blacklists input data as appropriate for test (§4.2.5).
4. Given the LSST Science Pipelines version, the operator will generate the full config files and schema files (§4.2.7), which are then ingested into the Data Backbone.
5. Write a DRP pipeline workflow definition file from scratch or modify an existing file from github making its operations- and dataset-specific inputs match this test.
   (a) For LDM-503-2, the pipeline workflow definition file is written in a workflow control language (wcl) format as used by the DESDM Framework.
6. Make special hardware requests (e.g., disk or compute node reservations) if needed.

4.2.8.2 Execution

1. If HTCondor processes are not already running, start HTCondor processes on compute nodes. This step makes the compute nodes join the HTCondor Central Manager to create a working HTCondor Pool.
2. The execution for each tract of the input data in §4.2.5 will be submitted to the hardware in §4.2.4.1 using the configuration in §4.2.7.

3. During execution, the operator will use software to demonstrate the ability to check the processing status.
   (a) For LDM-503-2, the available Batch Production Service monitoring software consists of two commands: one to summarize currently submitted processing, one to get more details of single submission.
4. If the processing attempt completes, the attempt is marked as completed and tagged as potential for the next test steps. These campaign tags are used to make pre-release QA queries simpler.
5. If the processing attempt fails, the attempt is marked as failed.
6. If the processing attempt fails due to certain infrastructure configuration or transient instability (e.g., network blips), the processing of the tract can be tried again after the problem is resolved.

4.2.8.3 Basic Data Completeness and Integrity Checks

1. When the execution finishes, the success of the execution will be verified by checking the existence of the expected output data.
   (a) For each of the expected data products types (listed in §4.3.2) and each of the expected units (visits, patches, etc), verify the data product is in the Data Backbone and has filesize greater than zero via DB queries.
   (b) Verify the physical and location information in Data Backbone DB matches the Data Backbone filesystem and vice-versa.
2. Check that for each data product type has appropriate metadata saved for each file as defined in §4.2.7
3. Check provenance
   (a) Verify that each file can be linked with the step and processing attempt that created it via the Data Backbone.
   (b) Verify that the information linking input files to each step was saved to the Oracle database.
4. Check runtime metrics, such as the number of executions of each code, wallclock per step, wallclock per tract, etc.

4.3 DRP-00-10: Data Release Includes Required Data Products

4.3.1 Requirements

DMS-REQ-0334, DMS-REQ-0267, DMS-REQ-0268, DMS-REQ-0275, DMS-REQ-0279, DMS-REQ-0294.

4.3.2 Test items

This test will check that the basic data products which should be in an data release are generated by execution of the science payload.

These products will include:

- Source catalogs, derived from PVIs and coadded images (DMS-REQ-0267 & DMS-REQ-0277);
- Forced source catalogs (DMS-REQ-0268);
- Object catalogs (DMS-REQ-0275);
- Processed visit images (PVIs; DMS-REQ-0069);
- Coadded images (DMS-REQ-0279);

4.3.3 Intercase dependencies

- DRP-00-00

4.3.4 Environmental needs

4.3.4.1 Hardware The test shall be carried out on a machine with at least 16 GB of RAM and multiple CPU cores which has access to the `/datasets` shared (GPFS) filesystem at the LSST Data Facility.

4.3.4.2 Software Release 14.0 of the DM Software Stack will be pre-installed (following the procedure described in DRP-00-00).

4.3.5 Input specification

A complete processing of the Hyper Suprime-Cam "RC1" dataset (Appendix A.1.1 through the DRP Science Payload.

This dataset shall be made available in a standard LSST data repository, accessible via the "Data Butler".

It is not required that all combinations of visit and CCD have been processed successfully: a number of failures are expected. However, documentation to describe processing failures should be provided.

4.3.6 Output specification

None.

4.3.7 Procedure

- The DM Stack shall be initialized using the `loadLSST` script (as described in DRP-00-00).
- A "Data Butler" will be initialized to access the repository.
- For each of the expected data products types (listed in §4.3.2) and each of the expected units (PVIs, coadds, etc), the data product will be retrieved from the Butler and verified to be non-empty.

4.4 DRP-00-15: Scientific Verification of Source Catalog

4.4.1 Requirements

DMS-REQ-0334, DMS-REQ-0267, DMS-REQ-0347, DMS-REQ-0331.

4.4.2 Test items

This test will check that the source catalogs delivered by the DRP science payload meet the requirements laid down by LSE-61.

Specifically, this will demonstrate that:

- Measurements in the catalog are presented in flux units (DMS-REQ-0347);
- Derived quantities are provided in pre-computed columns (DMS-REQ-0331);
- Aperture corrections for different photometry algorithms are consistent.
- Photometry measurements are consistent with reference catalog photometry (including sources not used in photometric calibration).
- Astrometry measurements are consistent with reference catalog positions (including sources not used in astrometric calibration).

This test does not include quantitative targets for the science quality criteria; we instead require for each test that we be able to quickly construct a plot in which such a target can be visualized.

4.4.3 Intercase dependencies

- DRP-00-00
- DRP-00-10

4.4.4 Environmental needs

4.4.4.1 Hardware The test shall be carried out on a machine with at least 16 GB of RAM and multiple CPU cores which has access to the `/datasets` shared (GPFS) filesystem at the LSST Data Facility.

4.4.4.2 Software Release 14.0 of the DM Software Stack will be pre-installed (following the procedure described in DRP-00-00).

4.4.5 Input specification

A complete processing of the Hyper Suprime-Cam "RC1" dataset (Appendix A.1.1 through the DRP Science Payload.

This dataset shall be made available in a standard LSST data repository, accessible via the "Data Butler".

It is not required that all combinations of visit and CCD have been processed successfully: a number of failures are expected. However, documentation to describe processing failures should be provided.

4.4.6 Output specification

None.

4.4.7 Procedure

- The DM Stack shall be initialized using the `loadLSST` script (as described in DRP-00-00).
- A "Data Butler" will be initialized to access the repository.
- Scripts from the `pipe_analysis` package will be run on every visit to check for the presence of data products and make plots.

4.5 DRP-00-25: Scientific Verification of Object Catalog

4.5.1 Requirements

DMS-REQ-0334, DMS-REQ-0275, DMS-REQ-0347, DMS-REQ-0331.

4.5.2 Test items

This test will check that the object catalogs delivered by the DRP science payload meet the requirements laid down by LSE-61.

Specifically, this will demonstrate that:

- Measurements in the catalog are presented in flux units (DMS-REQ-0347);
- Derived quantities are provided in pre-computed columns (DMS-REQ-0331);
- Aperture corrections for different photometry algorithms are consistent.
- PSF models correctly predict the ellipticities of stars over each tract.
- Photometry measurements are consistent with reference catalog photometry (including sources not used in photometric calibration).
- Astrometry measurements are consistent with reference catalog positions (including sources not used in astrometric calibration).
- Forced and unforced photometry measurements are consistent.
- The slope of the stellar locus in color-color space is not a function of position on the sky.

This test does not include quantitative targets for the science quality criteria; we instead require for each test that we be able to quickly construct a plot in which such a target can be visualized.

All science quality tests in this section shall distinguish between blended and isolated objects.

4.5.3 Intercase dependencies

- DRP-00-00
- DRP-00-10

4.5.4 Environmental needs

4.5.4.1 Hardware The test shall be carried out on a machine with at least 16 GB of RAM and multiple CPU cores which has access to the `/datasets` shared (GPFS) filesystem at the LSST Data Facility.

4.5.4.2 Software Release 14.0 of the DM Software Stack will be pre-installed (following the procedure described in DRP-00-00).

4.5.5 Input specification

A complete processing of the Hyper Suprime-Cam "RC1" dataset (Appendix A.1.1 through the DRP Science Payload.

This dataset shall be made available in a standard LSST data repository, accessible via the "Data Butler".

It is not required that all combinations of visit and CCD have been processed successfully: a number of failures are expected. However, documentation to describe processing failures should be provided.

4.5.6 Output specification

None.

4.5.7 Procedure

- The DM Stack shall be initialized using the `loadLSST` script (as described in DRP-00-00).
- A "Data Butler" will be initialized to access the repository.
- Scripts from the `pipe_analysis` package will be run on every tract to check for the presence of data products and make plots

4.6 DRP-00-30: Scientific Verification of Processed Visit Images

4.6.1 Requirements

DMS-REQ-0334, DMS-REQ-0069, DMS-REQ-0327, DMS-REQ-0029, DMS-REQ-0070, DMS-REQ-0030, DMS-REQ-0072.

4.6.2 Test items

This test will check that the Processed Visit Images (PVIs) delivered by the DRP science payload meet the requirements laid down by LSE-61.

Specifically, this will demonstrate that:

- Processed visit images have been generated and persisted during payload execution;
- Each PVI includes a background model (DMS-REQ-0327), photometric zero-point (DMS-REQ-0029), spatially-varying PSF (DMS-REQ-0070) and WCS (DMS-REQ-0030).
- Saturated pixels are correctly masked.
- Pixels affected by cosmic rays are correctly masked.
- The background is not oversubtracted around bright objects.

This test does not include quantitative targets for the science quality criteria; we instead require for each test that we be able to quickly construct a plot or display summary images that allow such a target can be visualized.

4.6.3 Intercase dependencies

- DRP-00-00
- DRP-00-10

4.6.4 Environmental needs

4.6.4.1 Hardware The test shall be carried out on a machine with at least 16 GB of RAM and multiple CPU cores which has access to the `/datasets` shared (GPFS) filesystem at the LSST Data Facility.

4.6.4.2 Software Release 14.0 of the DM Software Stack will be pre-installed (following the procedure described in DRP-00-00).

4.6.5 Input specification

A complete processing of the Hyper Suprime-Cam "RC1" dataset (Appendix A.1.1 through the DRP Science Payload.

This dataset shall be made available in a standard LSST data repository, accessible via the "Data Butler".

It is not required that all combinations of visit and CCD have been processed successfully: a number of failures are expected. However, documentation to describe processing failures should be provided.

4.6.6 Output specification

None.

4.6.7 Procedure

- The DM Stack shall be initialized using the `loadLSST` script (as described in DRP-00-00).
- A "Data Butler" will be initialized to access the repository.
- For each processed CCD, the PVI will be retrieved from the Butler, and the existence of all components described in §4.6.2 will be verified.
- Scripts from the `pipe_analysis` package will be run on every visit to check for the presence of data products and make plots

- Five sensors will be chosen at random from each of two visits and inspected by eye for unmasked artifacts.

4.7 DRP-00-35: Scientific Verification of Coadd Images

4.7.1 Requirements

DMS-REQ-0334, DMS-REQ-0279, DMS-REQ-0278, DMS-REQ-0047.

4.7.2 Test items

This test will check that the coadded images delivered by the DRP science payload meet the requirements laid down by LSE-61.

Specifically, this will demonstrate that:

- Coadds have been generated and persisted during payload execution;
- Each coadd provides a spatially varying PSF model (DMS-REQ-0047).
- Saturated pixels are correctly masked.
- Pixels affected by satellite trails and ghosts are rejected from the coadd.
- The background is not oversubtracted around bright objects.

  This test does not include quantitative targets for the science quality criteria; we instead require for each test that we be able to quickly construct a plot or display summary images that allow such a target can be visualized.

4.7.3 Intercase dependencies

- DRP-00-00
- DRP-00-10

4.7.4 Environmental needs

4.7.4.1 Hardware The test shall be carried out on a machine with at least 16 GB of RAM and multiple CPU cores which has access to the `/datasets` shared (GPFS) filesystem at the LSST Data Facility.

4.7.4.2 Software Release 14.0 of the DM Software Stack will be pre-installed (following the procedure described in DRP-00-00).

4.7.5 Input specification

A complete processing of the Hyper Suprime-Cam "RC1" dataset (Appendix A.1.1 through the DRP Science Payload.

This dataset shall be made available in a standard LSST data repository, accessible via the "Data Butler".

It is not required that all combinations of visit and CCD have been processed successfully: a number of failures are expected. However, documentation to describe processing failures should be provided.

4.7.6 Output specification

None.

4.7.7 Procedure

- The DM Stack shall be initialized using the `loadLSST` script (as described in DRP-00-00).
- A "Data Butler" will be initialized to access the repository.
- For each combination of tract/patch/filter, the PVI will be retrieved from the Butler, and the existence of all components described in §4.6.2 will be verified.
- Scripts from the `pipe_analysis` package will be run on every visit to check for the presence of data products and make plots

- Ten patches will be chosen at random and inspected by eye for unmasked artifacts.

Here is what I got from Michelle Gower in email: I'm assuming based upon some comments you've made that we need to merge "Jim's" and my part of the test into an end-to-end test. If so, we'll need to get the level of details the same. I'm assuming that the reader shouldn't have to understand all of the details of each piece of the design.

Here's the first draft of some of the test specs and test report.

========== Test Spec

Note: Once the files have been ingested into the DBB, full tests of the Data Backbone services can be run for more thorough checks. See Data Backbone Services tests for details.

Procedure: * If not already available, set up test machines, services, accounts (ITC) * DBB gateway client machine that can see files output by L1 archiver * DBB gateway server machine that has: * File transfer service * Delivery area * Write access to Data Backbone filesystem(s) * Database with apropriate schema * Authentication to file transfer service and database using LSST AA(?) service.

* Install and configure software * DBB Gateway client machine - dbb_gwclient and prereqs * DBB Gateway server machine - dbb_gateway and prereqs

* If not already running, start test services * (L1 test stand services) * DBB Gateway * Monitoring

* The L1 test stand is triggered to save 1 or more raw fits files.

* After the test L1 archiver has output files, the DBB gateway client will stage the files plus appropriate information to the test DBB gateway.

* The test DBB Gateway service will automatically ingest the staged file into the test DBB which includes saving appropriate location, physical, science, and provenance information to the database. Spot check data in the database and the DBB filesystem or run DBB tests.

* The test DBB services will automatically ensure that copies of the files go to the right DBB

locations as well as in disaster recovery. Spot check files are in the correct locations or run DBB tests.

* Run spot checks to ensure meet accessibility requirements or run DBB tests.

========== Test Report

Test systems used: * The DBB Gateway client was run on user's workstation with no direct access to the L1 test stand outputs. * The DBB Gateway service was run on a temporary virtual machine running HTTPS/webdav. * The DBB database was a single-node Oracle system.

Differences in procedure for 503-4b: * (The test file was manually created by Felipe instead of the L1 test stand.) * The test file was manually copied to a non-L1 test stand machine to continue rest of test. * The test DBB gateway client is manually executed. Integration work to automate the process is future milestone. It is expected * The test DBB Gateway service was also manually executed. * Since both ends of the process was run by user, only testing user authentication (as opposed to service accounts) * The test DBB Gateway service stores no science information in the DB. Temporary code in place waiting for Gen3 Butler. * There was a single site, single copy with no disaster recovery. * There was no monitoring. * Did manual checks inside the DBB.

Results: Within the restrictions for this milestone, the test was successful. Following the modified test procedure with the available hardware, an ATS raw file along with information including user and md5sum were sent via HTTPs to the delivery area on the DBB gateway machine where another program was executed to copy the raw file to the appropriate test DBB directory as well as save information to the DBB database tables.

A The Hyper Suprime-Cam "RC" datasets

A.1 RC1

The original HSC "release candidate" dataset was defined as part of testing release 3.9.0 of the HSC pipeline (derived from the LSST DM Stack). It consists of 237 visits to the HSC ultra-deep Cosmos field and 83 visits to the HSC wide survey. Specifically, this includes the following

visits[1]:

A.1.1 Ultra-deep Cosmos

HSC-G

11690..11712:2^29324^29326^29336^29340^29350^29352

HSC-R

1202..1220:2^23692^23694^23704^23706^23716^23718

HSC-I

1228..1232:2^1236..1248:2^19658^19660^19662^19680^19682^19684^
19694^19696^19698^19708^19710^19712^30482..30504:2

HSC-Y

274..302:2^306..334:2^342..370:2^1858..1862:2^1868..1882:2^11718..11742:2^22602..
22608:2^22626..22632:2^22642..22648:2^22658..22664:2

HSC-Z

1166..1194:2^17900..17908:2^17926..17934:2^17944..17952:2^17962^28354..28402:2

NB0921

23038..23056:2^23594..23606:2^24298..24310:2^25810..25816:2

A.1.2 Wide

HSC-G

9852^9856^9860^9864^9868^9870^9888^9890^9898^9900^9904^9906^9912^11568^
11572^11576^11582^11588^11590^11596^11598

HSC-R

11442^11446^11450^11470^11476^11478^11506^11508^11532^11534

HSC-I

7300^7304^7308^7318^7322^7338^7340^7344^7348^7358^7360^7374^7384^7386^
19468^19470^19482^19484^19486

[1] Defined using the standard LSST command-line task syntax

HSC-Y

6478^6482^6486^6496^6498^6522^6524^6528^6532^6544^6546^6568^13152^13154

HSC-Z

9708^9712^9716^9724^9726^9730^9732^9736^9740^9750^9752^9764^9772^9774^17738^17740^17750^17752^17754