

The Large Synoptic Survey Telescope

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Data Release processing is the main consumer of computer cycles at the Archive Center

Producing an LSST Data Release

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Once a year after commissioning is complete the LSST Data Management system will process the entire collection of data taken by the survey to date to produce a new Data Release. This is a set of data products intended for scientific analysis which has been generated with a uniform set of algorithms and processing parameters and passes strict quality controls. Each Data Release will be preserved intact so that any derived results can be regenerated at will. The processing that generates a Data Release divides into an image processing pass and a catalog processing pass. Image processing itself is done in two main passes: differencing every science image from a template image, followed by detection and measurement of sources (Nightly Reduction Mode), and simultaneous processing of stacks of science images that cover a particular region of sky (Stack Processing Mode). Together, these populate the science database with a variety of static and time domain measures of object properties. The following catalog pass over this data performs final astrometric and photometric calibration, orbit determination for solar system objects, and object classification.

Site Roles and their Functions

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I. PURPOSE OF A DATA RELEASE

LSST produces data at two basic rates. Every night, science images are processed through the Nightly Pipeline in near real time, primarily to produce Alerts that notify the community of interesting transient events or new solar system objects. The nightly processing also updates the science database, which can be queried for the latest data at any time.

At a much slower rate, nominally once per year, a Data Release is produced. A Data Release is a consistent set of data products containing the results of the survey from its inception to the date of the release. Within a data release, all data products will be generated with the same processing algorithms and parameters, and will have passed stringent quality tests.

It is expected that all published science that results from LSST data will be based on a Data Release. Therefore, every Data Release will be saved indefinitely as a data product.

During the first year of the survey, data releases will be produced frequently, both to debug the process and to rapidly catalog high proper motion and variable objects. After the first year, data releases will be produced yearly.

II. DATA RELEASE PROCESSING

Data Release processing begins with an image processing pass, which:

Uses the best available calibration products to form science images with instrument signature removed.

Determines an accurate CCD-level WCS

Forms deep stacked images for use in visualization, image subtraction, and deep detection.

Detects sources in stacked images.

Measures object properties by fitting a single object model to the full set of images in the stack that contain the source. In general, this model is time dependent. Additionally, sources are measured individually in each image in the stack, even if their SNR is very low. Together, these provide full information on the properties of both bright and faint objects.

Runs a variant of the Nightly Pipeline to produce difference images, and measure sources that appear in them

Data Release processing concludes with a catalog pass, which:

Runs the Moving Object Processing System (MOPS), which forms tracks of solar system objects from sources detected in difference images, and determines orbits for them.

Performs astrometric calibration, which solves for accurate proper motions and parallaxes.

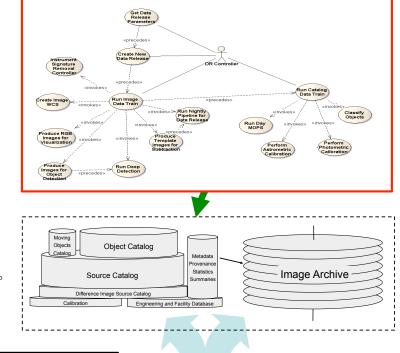
Performs photometric calibration, which utilizes photometry from the entire survey history, in conjunctior with auxiliary telescope measurements of probe stars, to produce accurate magnitudes at the top of the atmosphere.

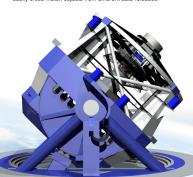
Classifies objects, based on their shapes, multiband photometric history, and astrometric history. Photo-Z's will be determined here. See poster #460.029

III. DATA PRODUCTS

A Data Release is a fully encapsulated set of data products, separate from other data releases, and archived for the life of the survey. All catalog products are contained within the LSST Science Database. All image products are contained within an Image Archive, indexed by image meta

Each data release begins with empty Object and Source Catalogs. There will not, in general, be a one-to-one correspondence between objects in different data releases. Objects will be given IAU compliant names that include the data release number, and object classification, eg LSST-DR2 J001234.65+123456.8 (SNIa). Tools will be provided to easily cross match objects from different data releases.





Data Product Sizes after 10 years

Images: 100 PB

Catalogs: 20 PB (3 x 10¹² rows in Source Catalog)

QUERY