Vera C. Rubin Observatory
Rubin Observatory Operations

Rubin Observatory Raw Data File Format

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CTN-004

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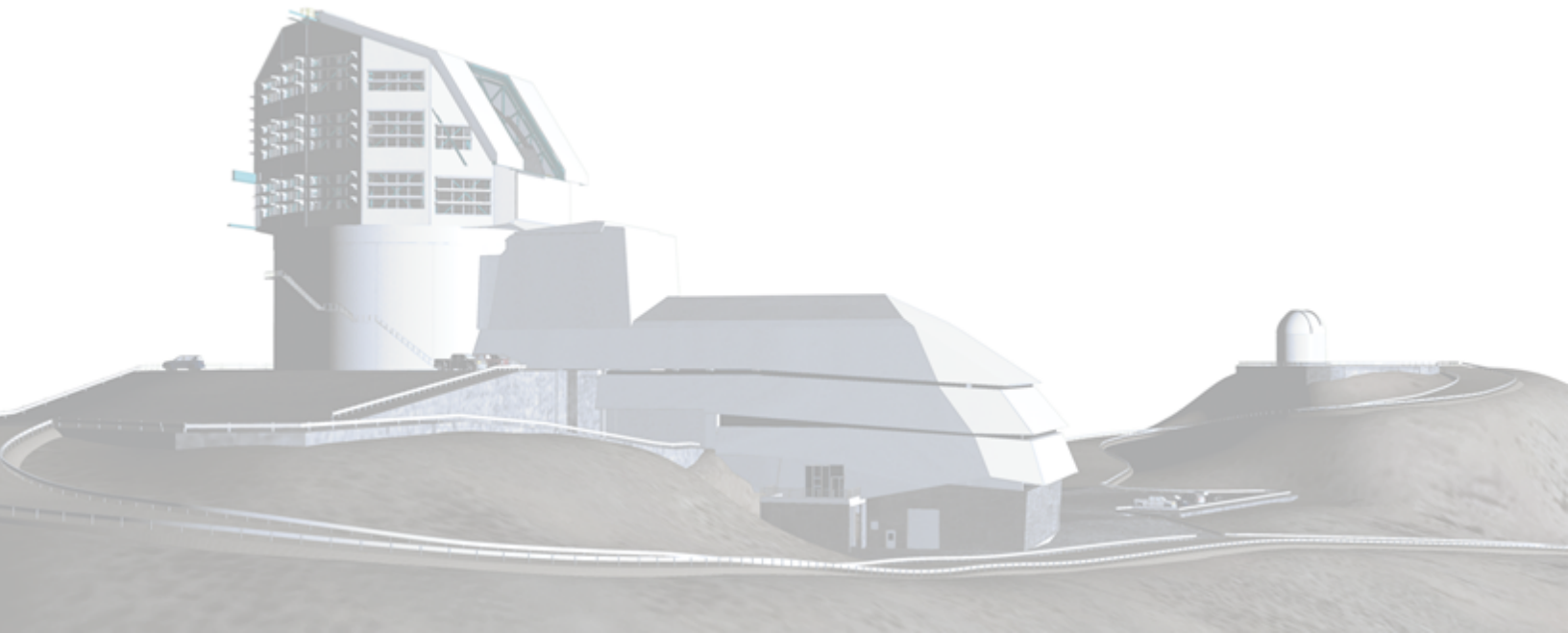
DRAFT



Abstract

At the NSF-DOE Vera C. Rubin Observatory we write data from the LSSTCam and LATISS instruments using FITS format with one file written per detector. Here we discuss the layout of those FITS files and describe the FITS headers.

Change Record

Version	Date	Description	Owner name
1	YYYY-MM-DD	Unreleased.	Jenness

Document source location: `https://github.com/lsst/ctn-004`

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1 Introduction

All three cameras at the NSF-DOE Vera C. Rubin Observatory, (LSSTCam (SLAC National Accelerator Laboratory & NSF-DOE Vera C. Rubin Observatory, 2025), LATISS (NSF-DOE Vera C. Rubin Observatory, 2020), and LSSTComCam (SLAC National Accelerator Laboratory & NSF-DOE Vera C. Rubin Observatory, 2024)) write FITS output files in the same structure with some minor variations in the FITS headers indicating different software versions and capabilities.

? defines the file format used for the test stand at SLAC and LSE-400 describes an example header that was used early in the construction project. This document describes the delivered system and any evolution of the format that happens during the observatory lifetime.

2 Structure

The basic layout of a Rubin camera FITS file is shown in Fig. 1. There is a primary header, with no data, containing the FITS headers for this observation. Then there are 16 HDUs, named `SegmentNN`, with the data from each amplifier along with headers specific to that amplifier. The data values are 32-bit integers compressed using the Rice compression algorithm (White et al., 2012). Finally there are two extensions describing the condition of the readout electronics board (`REB_COND`) and checksums calculated from the camera configuration (`CONFIG_COND`).

3 FITS Headers

3.1 Primary Header

A Version Changes

When the FITS header schema is changed in any way there is a corresponding increment to the value stored in the `HEADVER` FITS card. This document describes the file format starting with version 2, which is the version that was used to begin commissioning.

```
No.    Name      Ver    Type      Cards   Dimensions   Format
  0  PRIMARY       1 PrimaryHDU     134   ()
  1  Segment10     1 CompImageHDU    115   (576, 2048)   int32
  2  Segment11     1 CompImageHDU    115   (576, 2048)   int32
  3  Segment12     1 CompImageHDU    115   (576, 2048)   int32
  4  Segment13     1 CompImageHDU    115   (576, 2048)   int32
  5  Segment14     1 CompImageHDU    115   (576, 2048)   int32
  6  Segment15     1 CompImageHDU    115   (576, 2048)   int32
  7  Segment16     1 CompImageHDU    115   (576, 2048)   int32
  8  Segment17     1 CompImageHDU    115   (576, 2048)   int32
  9  Segment07     1 CompImageHDU    115   (576, 2048)   int32
 10  Segment06     1 CompImageHDU    115   (576, 2048)   int32
 11  Segment05     1 CompImageHDU    115   (576, 2048)   int32
 12  Segment04     1 CompImageHDU    115   (576, 2048)   int32
 13  Segment03     1 CompImageHDU    115   (576, 2048)   int32
 14  Segment02     1 CompImageHDU    115   (576, 2048)   int32
 15  Segment01     1 CompImageHDU    115   (576, 2048)   int32
 16  Segment00     1 CompImageHDU    115   (576, 2048)   int32
 17  REB_COND      1 BinTableHDU    107   0R x 0C   []
 18  CONFIG_COND    1 BinTableHDU     26   0R x 0C   []
```

FIGURE 1: Layout of a LSSTCam raw file.

B Acknowledgements

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C References

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D Acronyms

Acronym	Description
AST	NSF Division of Astronomical Sciences
AURA	Association of Universities for Research in Astronomy
CTN	Camera Technical Note
DE-AC02	Department of Energy contract number prefix
DOE	Department of Energy
FITS	Flexible Image Transport System
LATISS	LSST Atmospheric Transmission Imager and Slitless Spectrograph
LCA	Document handle LSST camera subsystem controlled documents
LSE	LSST Systems Engineering (Document Handle)
LSST-DA	LSST Discovery Alliance
LSSTCam	LSST Science Camera
LSSTComCam	Rubin Commissioning Camera
NSF	National Science Foundation

REB	Readout Electronics Board
SLAC	SLAC National Accelerator Laboratory