

## Installation and Performance of the LSST Camera Refrigeration System

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### ABSTRACT

This is the abstract.

## 1. INTRODUCTION

### 1.1. *System Requirements*

1. CCDs and readout electronics contained in same vacuum chamber
2. Two-system solution for multiple thermal zones
  - (a) Cold system cools readout electronics
  - (b) Cryo system cools CCDs

### 1.2. *Hardware Overview*

1. Cryostat thermal zones
  - (a) Crossflow design (cold system)
  - (b) Separated thermal zones
  - (c) Multiple independent circuits in parallel (cryo system)
2. Heat Exchangers
3. Refrigeration Cabinets
4. Refrigeration lines

### 1.3. *Testing Overview*

1. SLAC I&T
2. Pathfinder (including purpose and goals)
3. TMA refrigeration system

## 2. SYSTEM ARCHITECTURE

Description of the physical components of the final LSST Camera Refrigeration System as implemented on the TMA. Overview of system design and refrigeration theory for both cold and cryo systems. Discussion of differences between this system and the system used at SLAC as well as the Refrigeration Pathfinder. Physical hardware includes the heat exchangers on the Camera itself as well as the refrigeration cabinets and the refrigeration lines connecting the two assemblies.

### 2.1. *TMA Refrigeration System*

1. Final System Hardware
2. SLAC I&T Configuration Differences
3. Refrigeration Pathfinder Setup

### 2.2. *Control and Protection Systems*

1. SLAC I&T vs TMA
2. Refrigeration Pathfinder Controls

## 3. TEST PROCEDURES

Description of the tests performed at SLAC and on the summit in various configurations.

### 3.1. *SLAC I&T Testing*

### 3.2. *Refrigeration Pathfinder Testing*

### 3.3. *Final Camera System Testing*

## 4. RESULTS

Presentation of collected data.

### 4.1. *SLAC I&T Functionality*

### 4.2. *Refrigeration Pathfinder Functionality*

### 4.3. *Final Camera System Functionality*

## 5. DISCUSSION

Analysis of collected data.

## APPENDIX

### A. REFERENCES

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## B. ACRONYMS

<b>Acronym</b>	<b>Description</b>
DAQ	Data Acquisition System
DM	Data Management
EPO	Education and Public Outreach
I&T	Integration and Test
LSST	Legacy Survey of Space and Time (formerly Large Synoptic Survey Telescope)
SLAC	SLAC National Accelerator Laboratory (formerly Stanford Linear Accelerator Center; SLAC is now no longer an acronym)
TMA	Telescope Mount Assembly