Large Synoptic Survey Telescope

Design Overview of the LSST Camera

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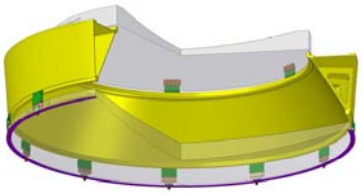
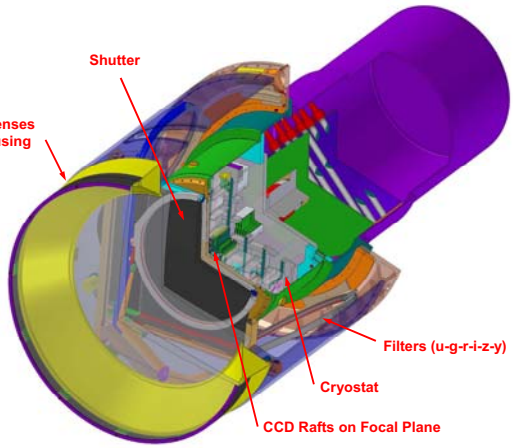
The LSST camera will be the largest digital camera ever built. As such, its design presents a number of challenges. The field of view will be 3.5 degrees in diameter and will be sampled by a 3.2 billion pixel array of sensors. The entire array must be readout in under 2 s, which leads to demanding constraints on the sensor architecture and the readout electronics. In addition, given the fast optical beam (f 1.2), the build tolerances on the assembly and alignment of the focal plane are tight. The camera incorporates three very large refractive lenses, an array of five large filters mounted on a carrousel, and a mechanical shutter.
We will present an overview of the baseline camera design, with an emphasis on key aspects of our development program.

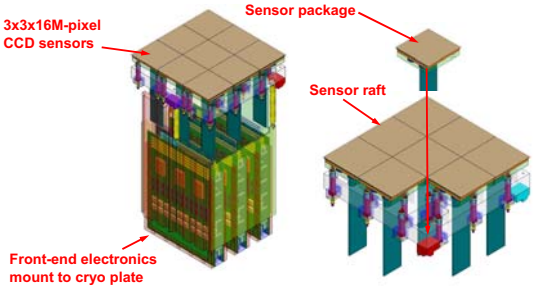
L1/L2 Lens Assembly



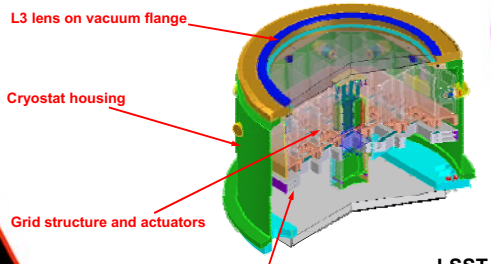
Cut-Away View of LSST Camera Assembly



LSST Raft Tower

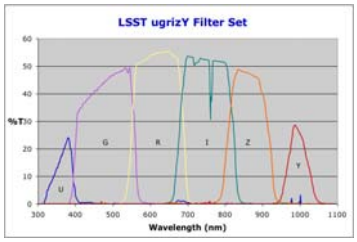


Cut-Away View of Cryostat with Raft and Electronics

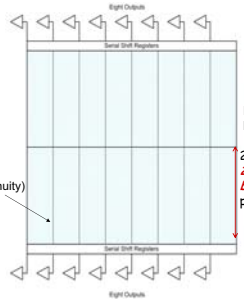


- FPA is ~ 200 4K x 4K CCDs, each with 32 outputs
  - *6400* video channels/FPA total
- Sensors organized into identical rafts of 3 x 3 sensors
- Clocking of science CCDs is *synchronous* and global throughout the FPA
  - 250 kpix/sec * 32 ouputs/CCD * 200 CCDs = 3.2 Gpix/2sec
- A raft is an autonomous object and can function as a complete camera
  - 288 channels/raft
  - readout electronics fit in "shadow" of sensors
- *16-bit dynamic range* is handled by a single-gain readout
- *LSST-specific ASIC(s)* will be developed to handle analog front-end functions

LSST Filter Set



Multi-port 4K x 4K CCD Design

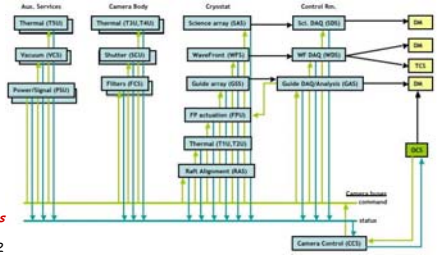


Blooming column length ***2000*** pixels

2 *contiguous imaging areas* ***2kx4k*** separated by a ***blooming stop*** less than 1-2 pixel rows wide

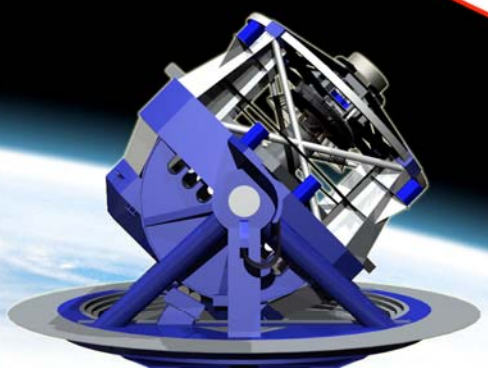
Readout segment boundary (no discontinuity)

Camera Control System



Desired features:

- ***2 sec readout @ 250 kHz implies no more than ca. 500K pixels per output.***
- Fill factor must approach unity (which favors a fairly large area footprint ~ 16 cm2).
- Flatness requirements argue for bond pads only on periphery.
- Segmentation for ***blooming control*** of very bright stars – no more than ca. 500 pixels in the parallel direction per segment.
- ***Contiguous imaging area*** should be at least 500 pixels in the parallel direction.



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