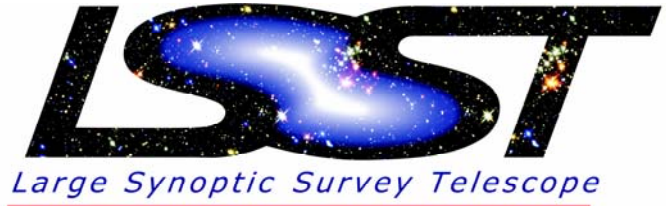


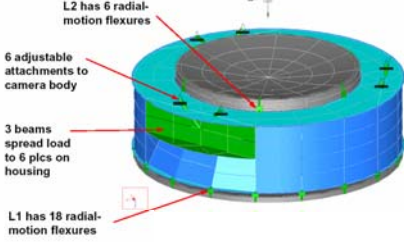
# Design Overview of the LSST Camera

K. Gilmore (SLAC), S. Kahn (SLAC) and the LSST Camera Team

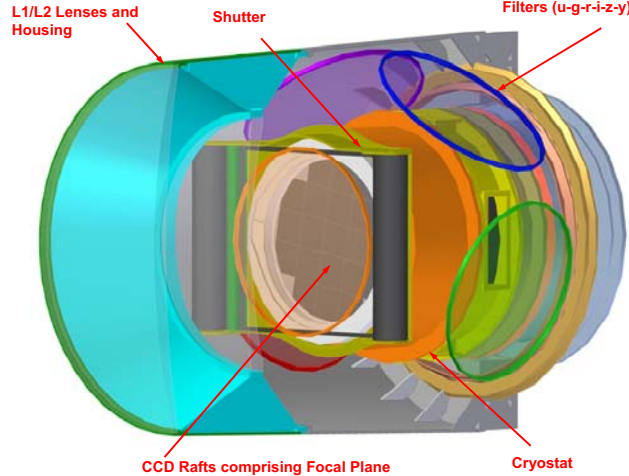


The LSST camera is a wide-field optical (0.4–1  $\mu\text{m}$ ) imager designed to provide a 3.5° FOV with better than 0.2 arcsecond sampling. The image surface is flat with a diameter of approximately 64 cm. The detector format will comprise a mosaic of 16 Mpixel silicon detectors providing a total of approximately 3.2 Gpixels. The camera includes a filter changing mechanism and shutter. It is positioned in the middle of the telescope where cross-section area is constrained by optical vignetting and heat dissipation must be controlled to limit thermal gradients in the optical beam. The camera must produce data of extremely high quality with minimal downtime and maintenance. This poster illustrates the current design of the LSST camera system components.

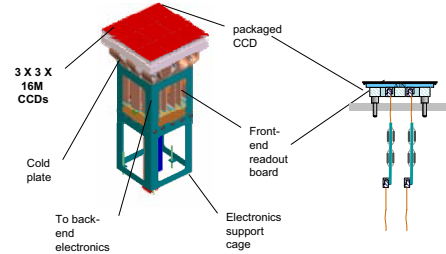
Finite element model of front-end optic assembly  
Total mass is 650 kg using 10 Ga (.135") steel walls and 1/2" steel flanges



## Cut-Away View of LSST Camera Assembly



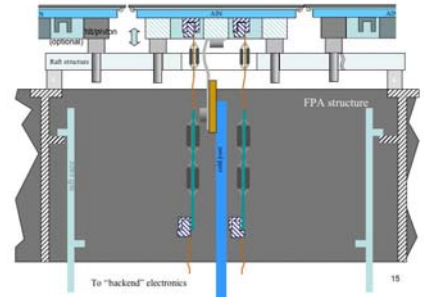
## LSST Front End Electronics Integration



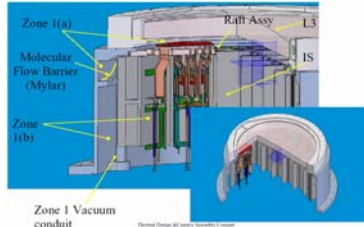
- FPA is ~ 200 4K x 4K CCDs, each with 32 outputs
  - 6400 video channels/FPA total
- Sensors organized into identical rafts of 3 x 3 sensors
- Clocking of science CCDs is *synchronous* and global throughout the FPA
  - 250 kpix/sec \* 32 outputs/CCD \* 200 CCDs = 3.2 Gpix/2sec
- A raft is an autonomous 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

- We have advanced the camera design on nearly all fronts over the past six months, and are close to having working designs or concepts for all sub-assemblies
- We have started the process of bringing the design together into one self-consistent design—a baseline design
- Over the next six months we will baseline the key requirements, complete the trade-offs, and work the open design and operations issues
- The result of this process will be a baseline design suitable for our project execution plan and subsequent proposal

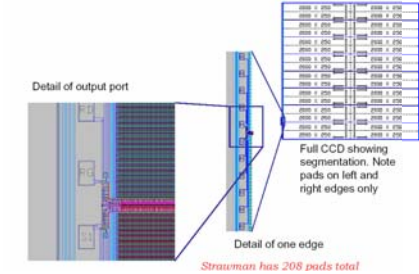
## Cross-Section View of Cryostat Layout



## Cut-Away View of Cryostat with Raft and Electronics



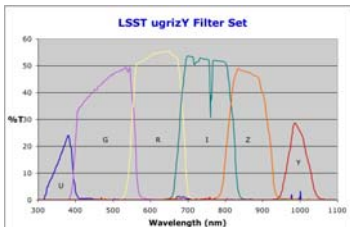
## Multi-port 4K x 4K CCD Design



## Desired features:

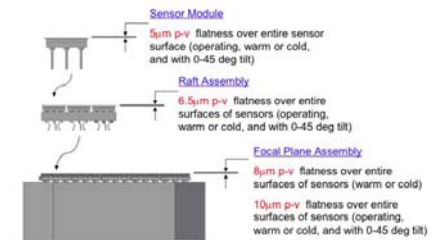
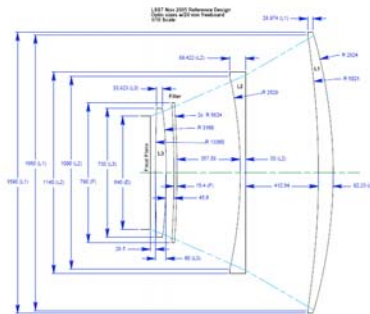
- 2 sec readout @ 250 kHz implies no more than ca. 500K pixels per output.
- Fill factor must approach unity (which favors a fairly large area footprint ~ 16 cm<sup>2</sup>).
- Flatness requirements argue for bond pads only on periphery.
- Segmentation for *blooming control* of very bright stars — no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

## LSST Filter Set



## Design Specifications:

- Based on Sloan Digital Sky Survey Filter Set
- 75cm round filters
- ~100 layers/coating on monolithic substrate
- Beam that is incident on the filter has a focal ratio of f/1.25 with a 61.5% obscuration.
- The filter is concentric about the chief ray so that all portions of the filter see the same angle of incidence range, about 14.2° to 23.6°



Tolerance allocation for the alignment of the focal plane array.

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