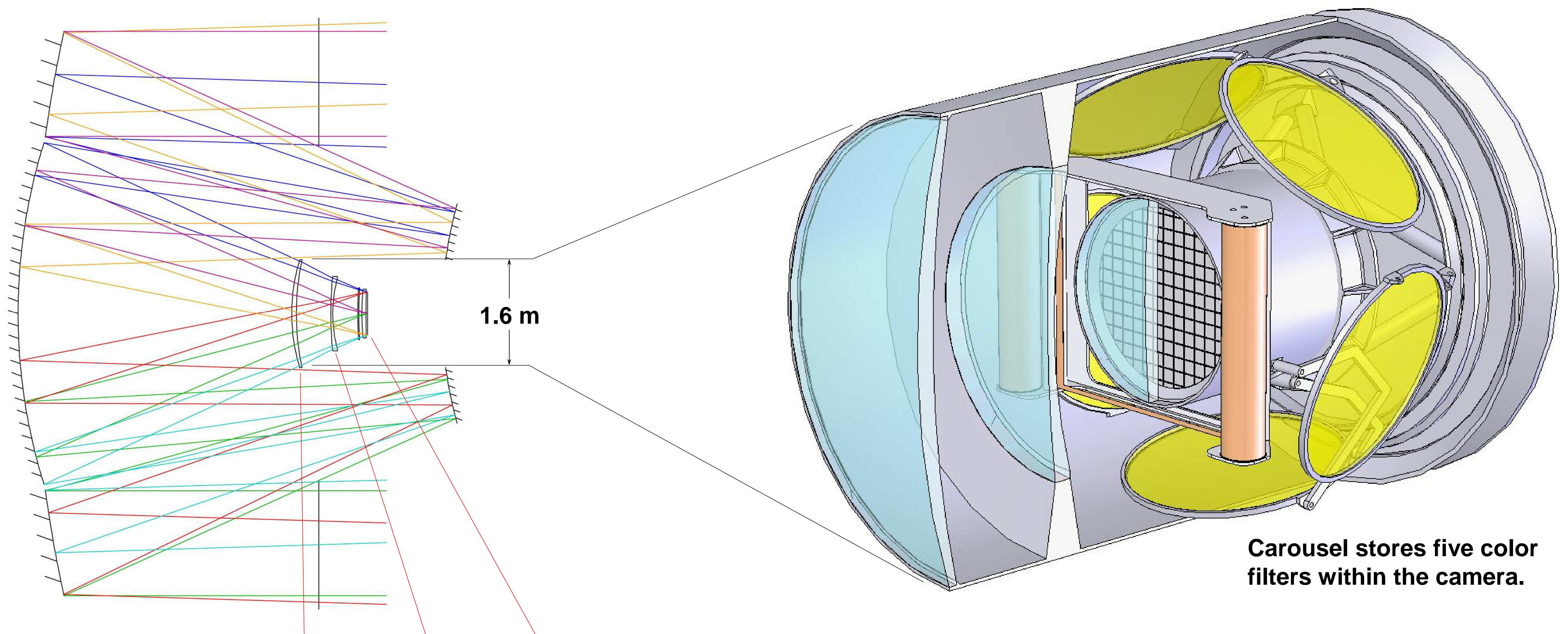


# The Optical and Mechanical Design of the LSST Camera

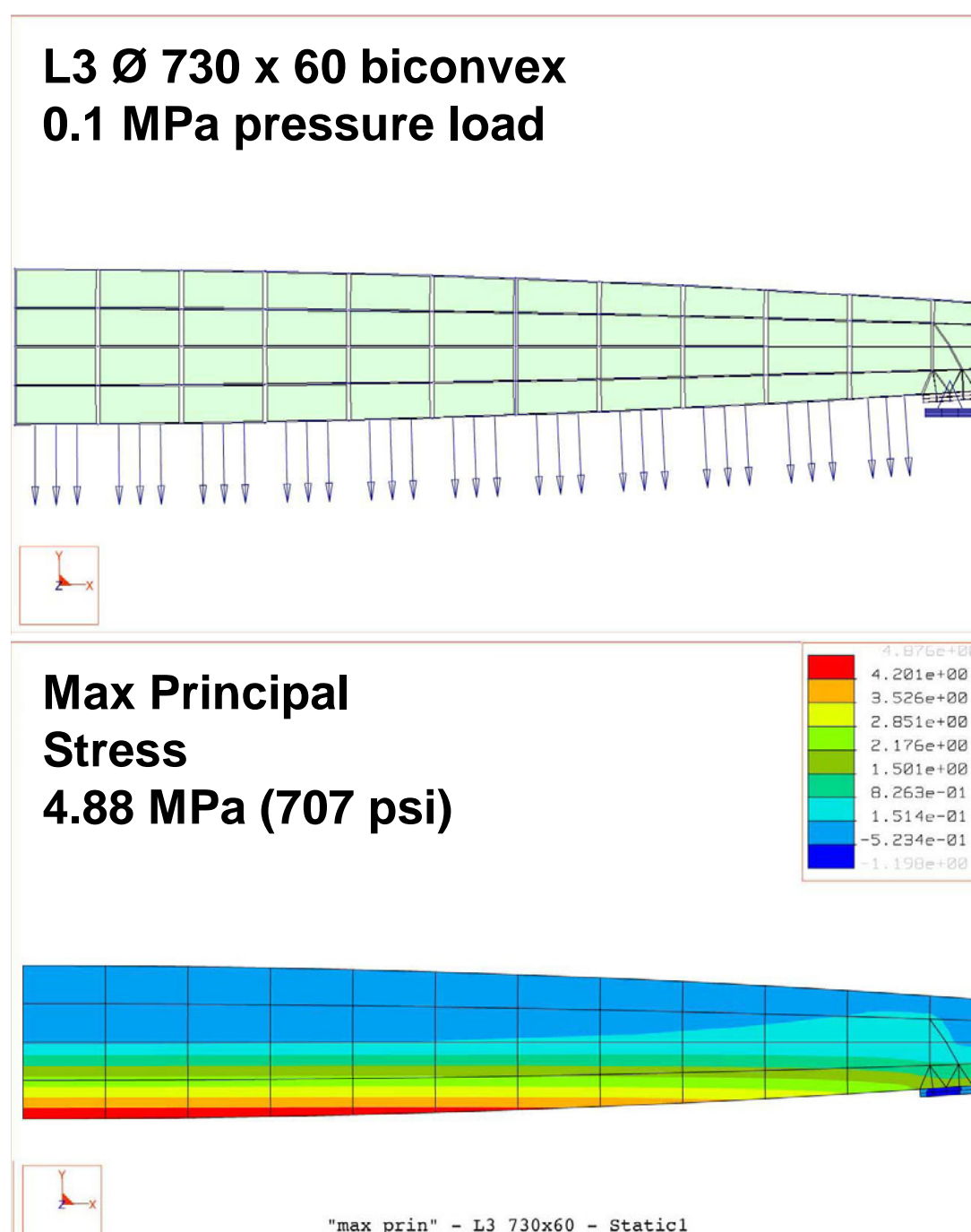
Layton C. Hale (LLNL) for the LSST Camera Team

The LSST Camera requires: three large (1.6 m, 1.1 m and 0.73 m) refractive optics; five 0.78 m auto-changing color filters; a mechanical shutter; a tiled sensor array at focus spanning 0.64 m with 3.2e9 pixels and their associated electrical devices with many thousands of interconnections. The optical elements require precise alignment and one requires actuation for focus adjustment. For example, the focal plane array, which operates at 180 K, must be flat to 10  $\mu\text{m}$  P-V for any orientation of the telescope. Work has been underway to allocate space and package these items, devise workable concepts for the mechanisms, and design structural elements (e.g., optic mounts and housings) that can be manufactured precisely and adjusted as necessary to meet alignment and stability requirements. This poster presents work to date relating to the optical and mechanical design of the LSST camera. (UCRL-POST-208722)

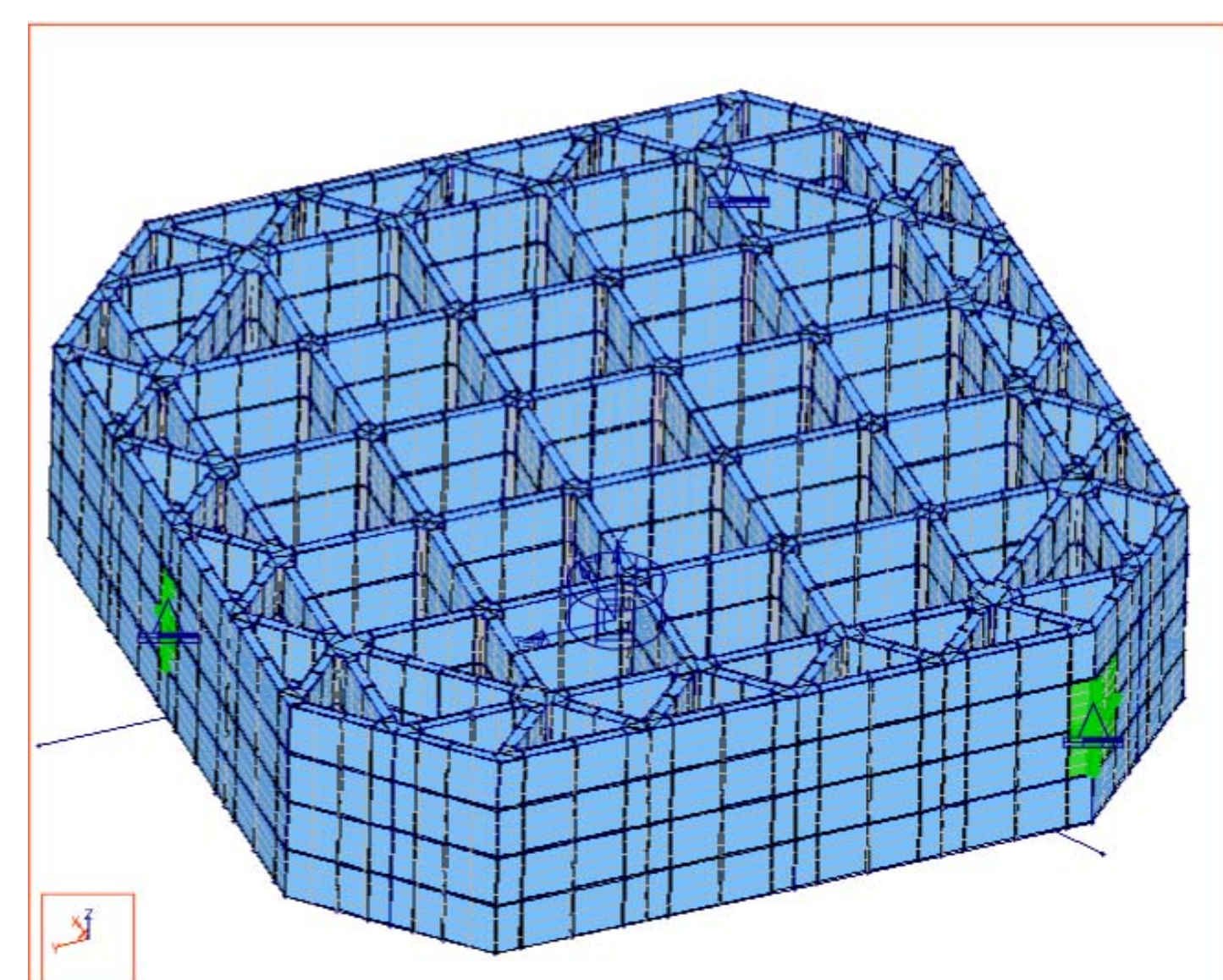
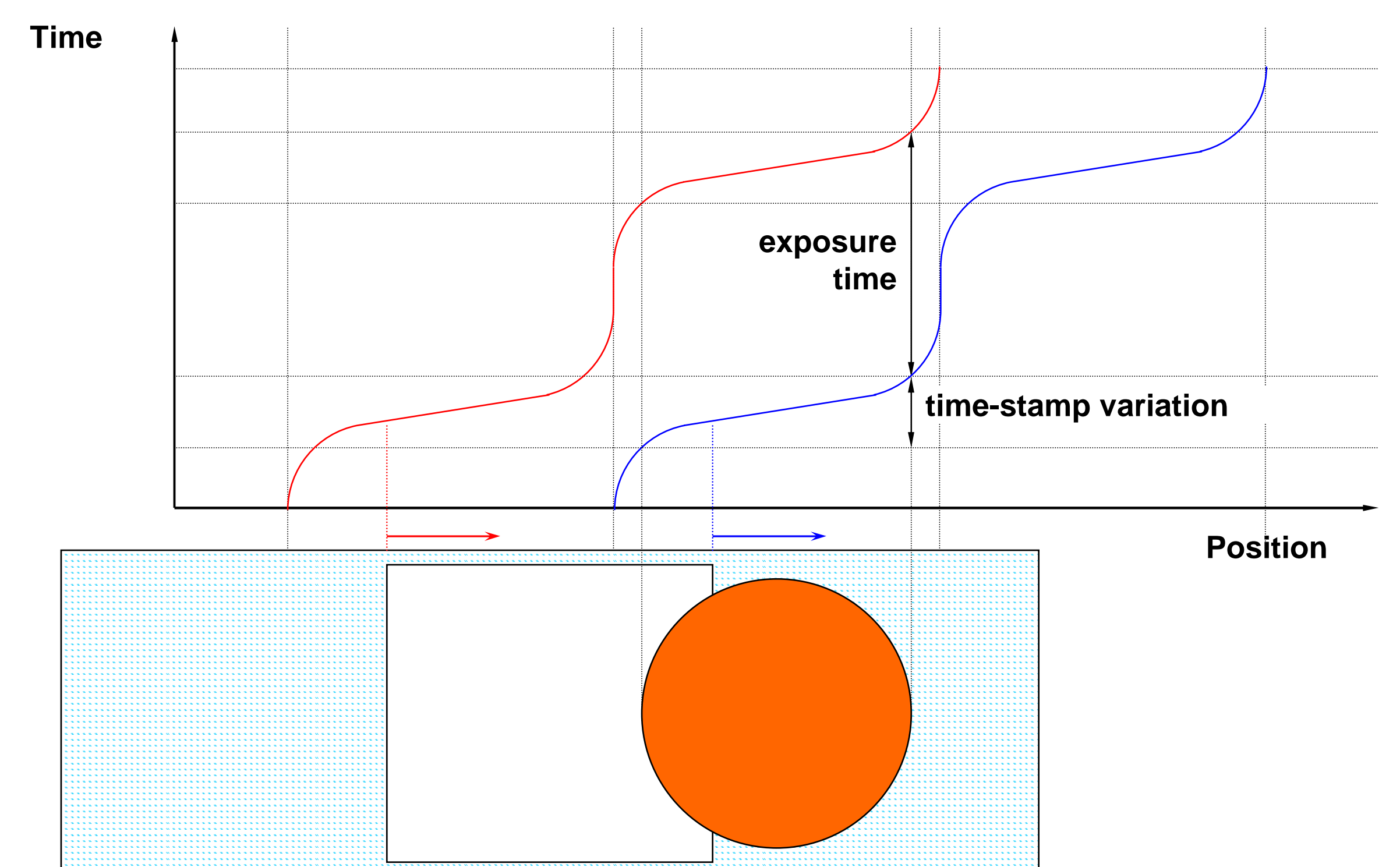


Property	Unit	L1	L2	L3	Filter
Aperture radius	mm	780	531	345	371
Freeboard	mm	20	19	20	19
Outer diameter	mm	1600	1100	730	780
S1 spherical radius	mm	2739.4	5198.6	3625.5	5630.3
S2 spherical radius	mm	-3803.2	-2058.5	-17192	-5630.3
Sag of S1	mm	119.417	29.176	18.420	13.524
Sag of S2	mm	-85.092	-74.836	-3.875	-13.524
Sag of centroid	mm	102.254	52.006	11.148	13.524
Center thickness	mm	68.312	30	60	16.433
Virtual edge thick.	mm	33.987	75.660	45.455	16.433
Actual edge thick.	mm	30.791	68.897	45.455	16.433
Aprox. volume	m <sup>3</sup>	0.1034	0.0500	0.0221	0.0079
Aprox. mass	kg	227.5	110.0	48.6	17.3

## FEA of L3 under vacuum load



## Scroll shutter provides equal exposure for all pixels.



## FEA of focal plane structure supported at three points

Analysis result	Steel	SiC	Invar-36
Mass (structure w/o payload)	210 kg	86.2 kg	216 kg
Z gravity sag over Ø 640 mm	0.40 $\mu\text{m}$	0.083 $\mu\text{m}$	0.59 $\mu\text{m}$
Torsion mode 1	227 Hz	497 Hz	187 Hz
X translation mode 2	274 Hz	600 Hz	226 Hz
Y translation mode 3	413 Hz	905 Hz	341 Hz
Mass (structure + 40 kg payload)	250 kg	126 kg	256 kg
Estimated Z gravity sag (Ø 640 mm)	0.48 $\mu\text{m}$	0.12 $\mu\text{m}$	0.70 $\mu\text{m}$

One motor drives both scrolls with belts, and a spring applies preload.

