The Status of the upgrade of the Super-LOTIS Telescope

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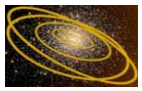
In Collaboration with the Cal Tech GRB Group



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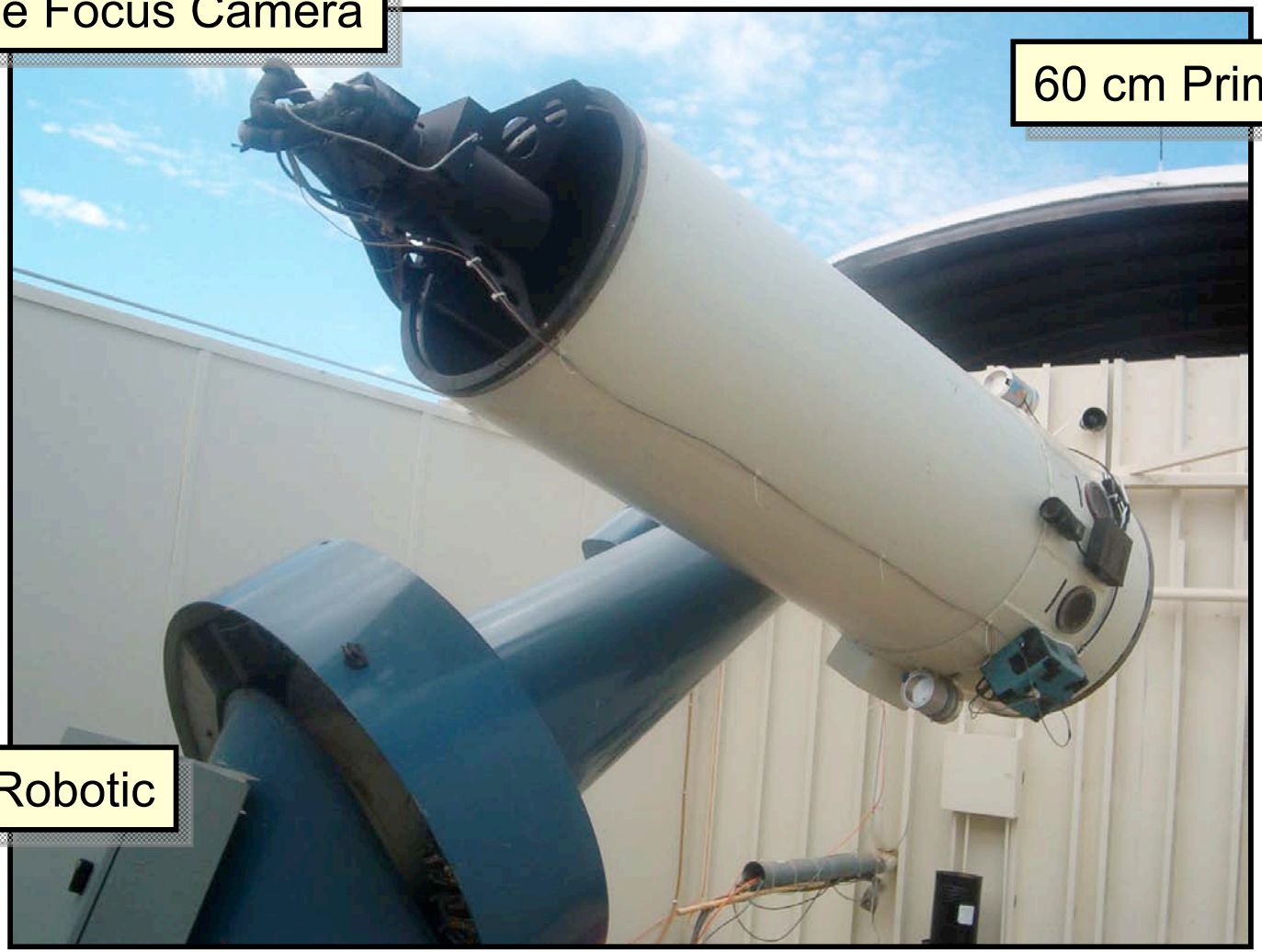
LOTIS

LIVERMORE OPTICAL TRANSIENT IMAGING SYSTEM

Super-LOTIS

Prime Focus Camera

60 cm Primary

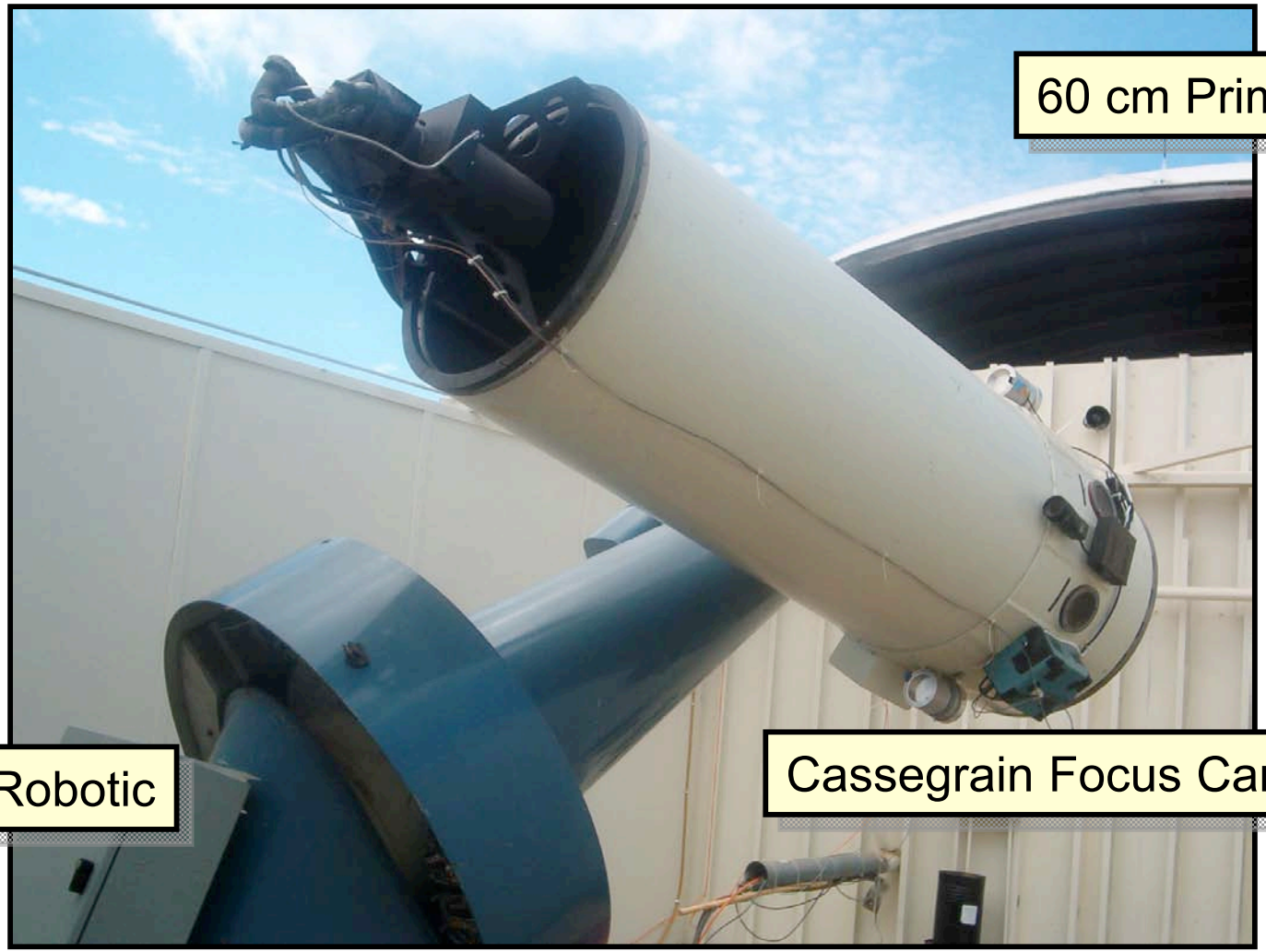


Fully Robotic

LOTIS

LIVERMORE OPTICAL TRANSIENT IMAGING SYSTEM

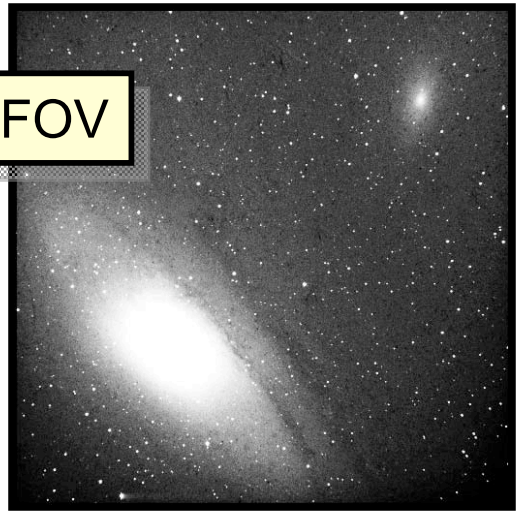
Super-LOTIS



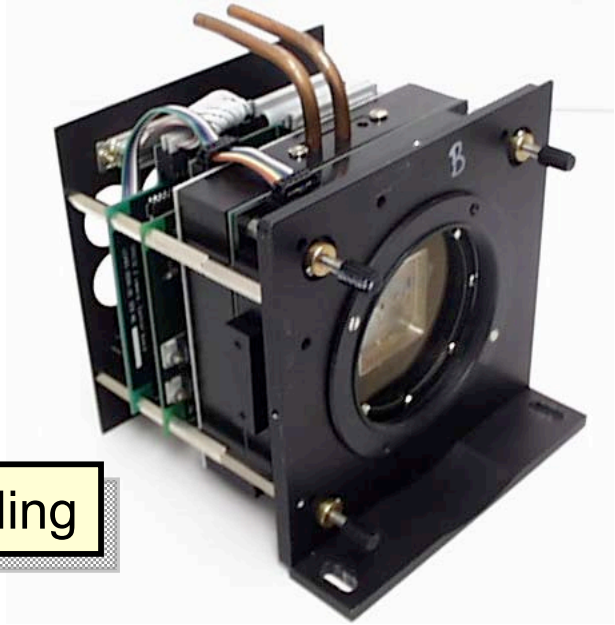
LOTIS
LIVERMORE OPTICAL TRANSIENT IMAGING SYSTEM

Super-LOTIS…..as it was….

- Operational: Mar. 1999 – July 2004
- Site: Steward Observatory Kitt Peak
- Mount: Boller & Chivens
- Response Time: < 20 s
- FPA: Loral 442, 2k x 2k,15_m pixels
- Optics: 60 cm, f/3.5,
  3 element prime focus corrector
- FOV: 51’ x 51’ (covered BATSE error boxes)
- Pixel Scale: 1.5”/pixel
- Limiting Magnitude: R ~ 19.0
- Filter Wheel: VRI

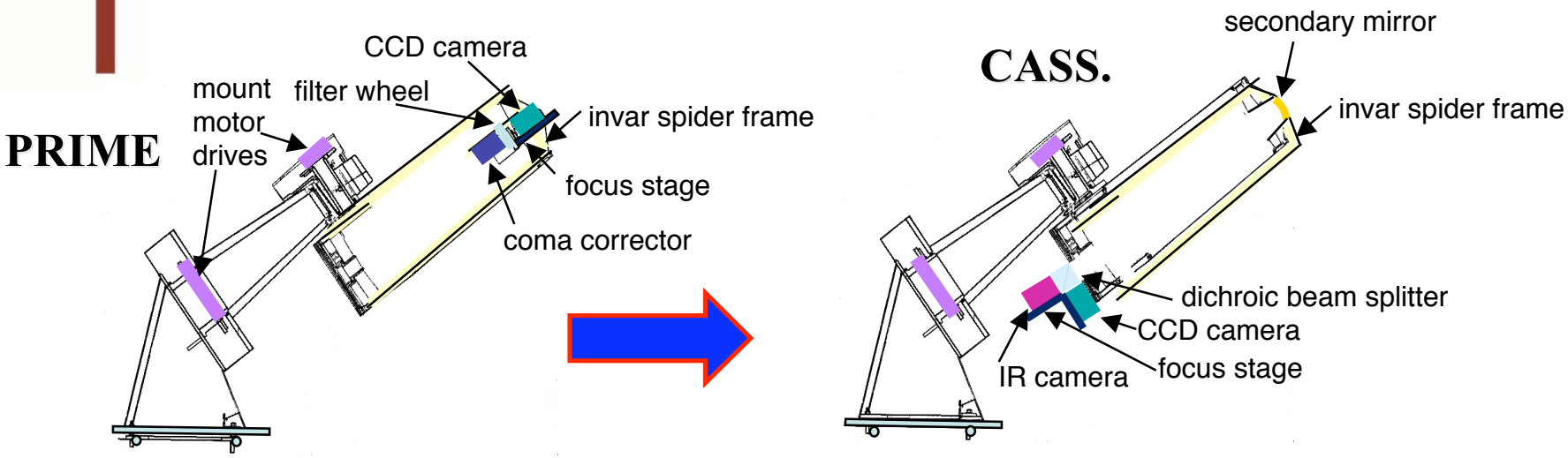

M31; 51’ FOV


SO Kitt Peak, CTI Building



Super-LOTIS…..as it will be....

- Simultaneous optical and NIR observations.
- New concrete telescope pier
- f/9 Secondary (24.0 cm)
- Cass CCD Camera – Spectral Instruments
  - R ~ 19.0
- Cass NIR Camera – CIRIM CTIO Near IR Imager
  - J ~ 16.0, H ~ 15.7, K ~ 15.3
- Complete in early 2005



http://slotis.kpno.noao.edu/~ggwilli/LOTIS/index.shtml

Upgrade Summary

1) Telescope re-mounted on concrete pier.
2) Switch to Cassegrain focus.
3) New optical camera
4) NIR camera
5) Mount control to
Steward Observatory's TCS system.
6) Maintenance and operation to
Steward Observatory

LOTIS
LIVERMORE OPTICAL TRANSIENT IMAGING SYSTEM

1) Concrete Pier

During the Fall of 2003, the telescope was removed and refurbished. A concrete pier was poured and the telescope was remounted & aligned.

2) Switch to Cassegrain focus

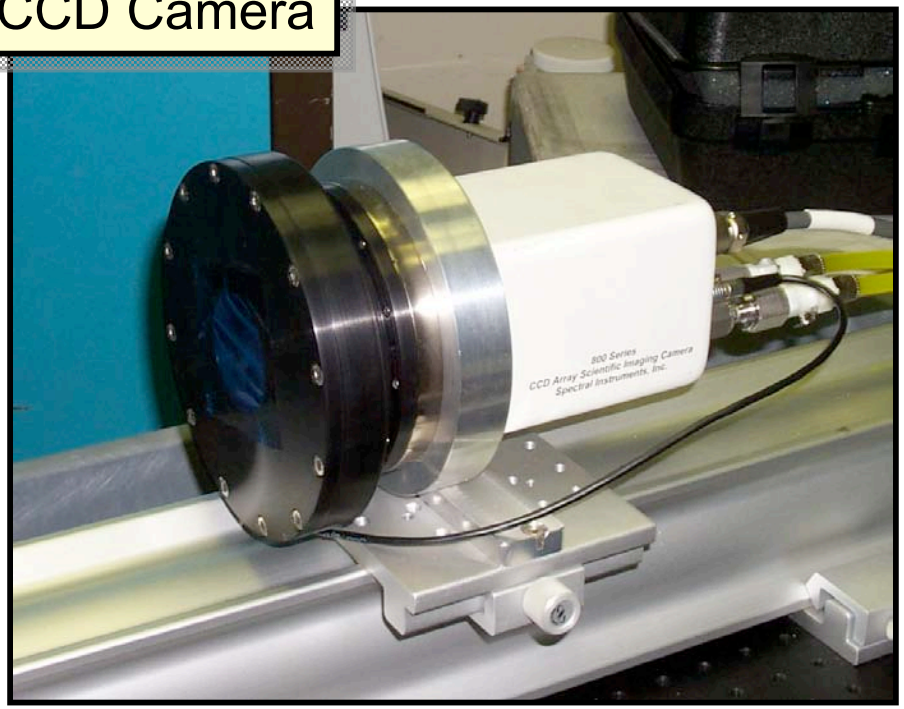
A secondary mirror has been delivered to LLNL, and will arrive at Kitt Peak to be mounted on the telescope. The secondary mount is being constructed by A.C.E. and will permit remote focus control via the "TCS" telescope control.

LOTIS
LIVERMORE OPTICAL TRANSIENT IMAGING SYSTEM

3) Optical CCD Camera

Spectral Instruments CCD Camera

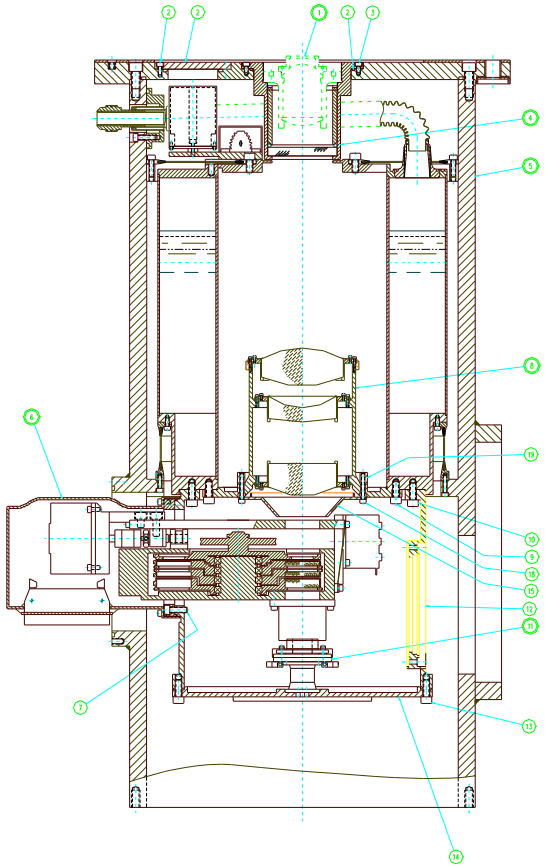
- CCD: EEV 42-40, thinned
- Pixels: 2048 x 2048, 13.5 _m
- Readout Rate: 100 – 800 kHz
- Read Noise: 5.59 e- @ 400 kHz
- Gain: 1.24 e-/ADU
- Operating Temperature: -35 ˚C
- Dark Current: < 0.07 e-/pix/s
- Full Well: 98.7 ke-
- Pixel Scale: 0.5”/pixel
- f/9 FOV: 17’ x 17’
- Filter Wheel: BVRI
- Limiting Magnitude: R ~ 19.0



LINUX drivers being tested, ready to be delivered.

4) NIR Camera

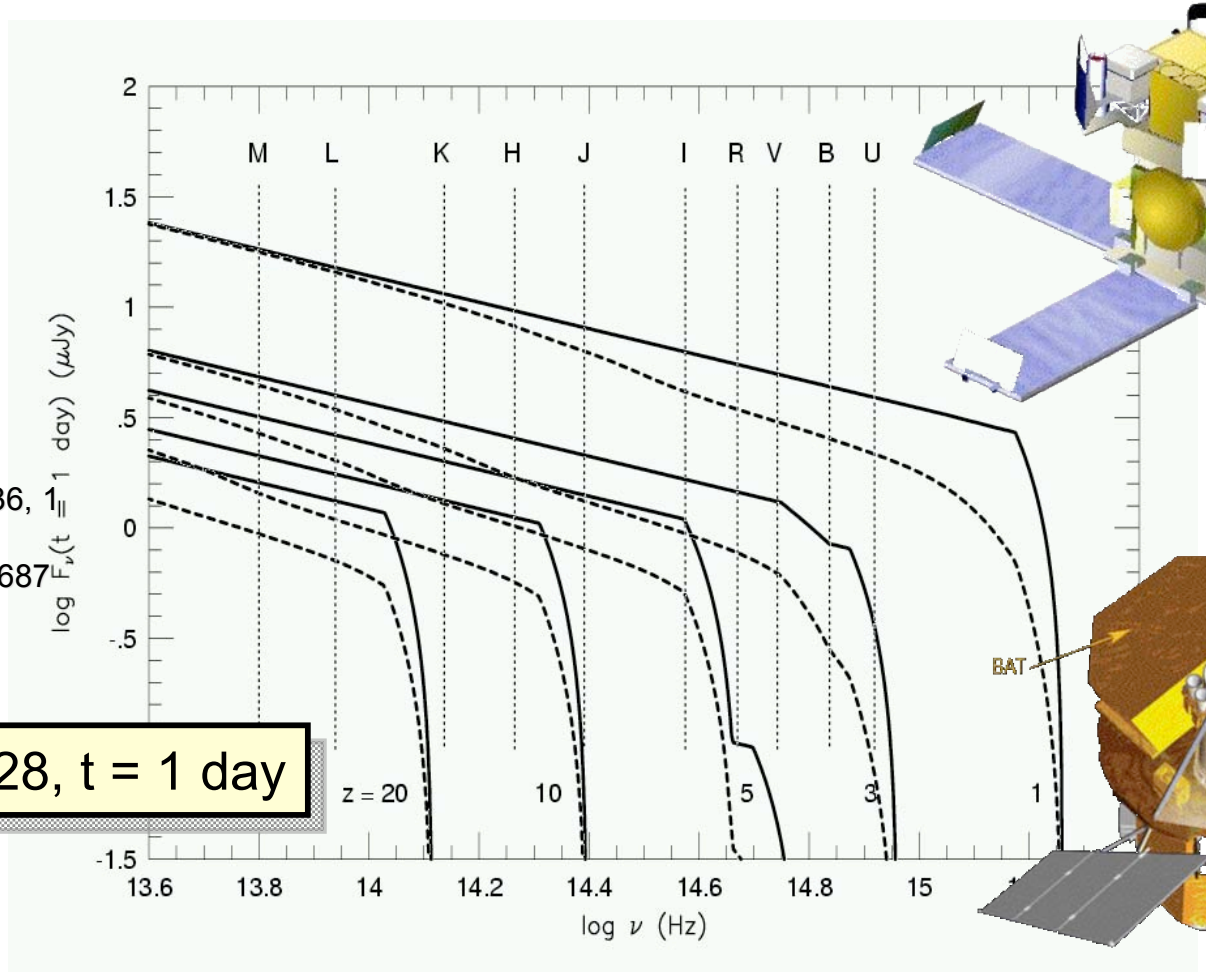
- CIRIM: Cerro Tololo InfraRed IMager
- Readout Electronics: IR Labs (upgradable)
- Array: 256x256 Pixel HgCdTe NICMOS-3 Rockwell Science Center
- Pixel Size: 40 _m x 40 _m
- Operating Temperature: LN2 @ 77K
- Read Noise: ~ 50 e-
- Gain: ~ 4 e-/ADU
- Dark Current: < 2.5 e-/pix/s
- Full Well: 130 ke-
- Pixel Scale: 1.5”/pixel
- f/9 FOV: 6.5’ x 6.5’ (Swift BAT error box ~ 5’)
- Filter Wheel: JHK_sK
- Limiting Magnitude: J = 16.0, H = 15.7, K = 15.3

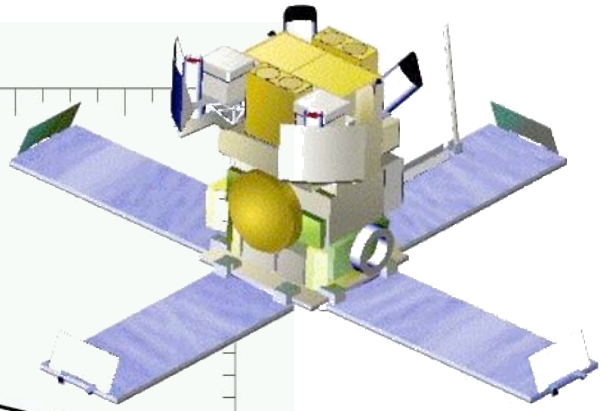


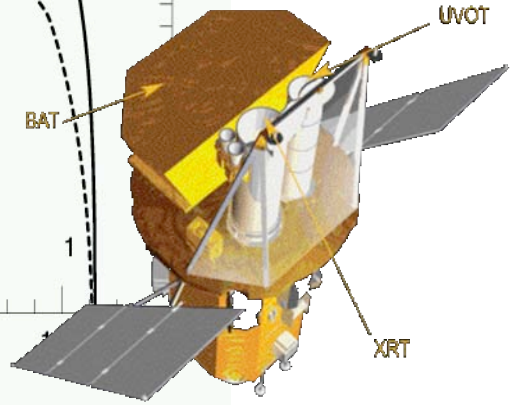
Will be ready in Spring 2005

Motivation for NIR Capability

1.) study the intrinsic NIR emission; prompt and afterglow (no Swift NIR)
2.) detect and observe optically obscured bursts; star forming regions
3.) detect and observe high redshift GRBs; Ly-_ absorption



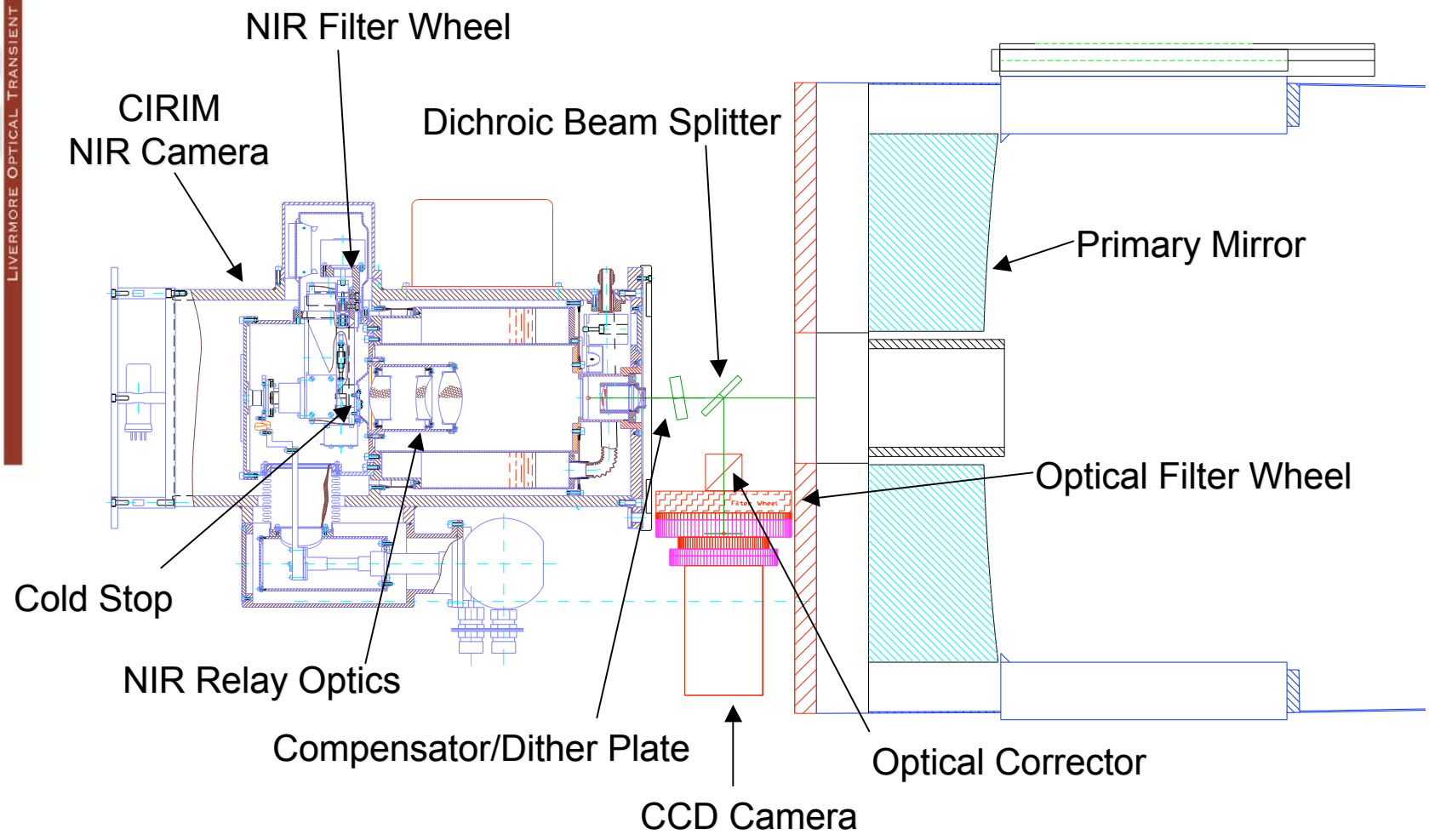




Lamb & Reichart ApJ 536, 1
see also:
Ciardi & Loeb ApJ 540, 687
Inque et al.
Gou et al.

GRB 970228, t = 1 day

Instrument Configuration



5) TCS Mount Control

Over the next 40 days, the telescope motors & encoders will be replaced as part of an upgrade to TCS telescope control. TCS is the standard control system for Steward Observatory, and its use is a requirement for Steward maintenance of SLOTIS. Software is being written to remotely operate TCS.

This software can potentially remotely operate other Steward telescopes that also use TCS (after certain adaptations). This might lead to additional telescopes becoming available for use detecting optical/NIR counterparts of GRBs.

6) Steward Maintenance & Operation of SLOTIS

One of the most important attributes for a telescope to be effective at detecting prompt optical/NIR emission from GRBs is to be operating a large fraction of the time. In an effort to improve the uptime for SLOTIS, upon completion of the upgrades the telescope will be operated under contract with the Steward Observatory mountain operations team. They average better than 99% uptime on the 17 telescopes under their control.

Supernova Science

In order to better utilize the telescope and to streamline the data analysis procedures, we will perform SN observations on a nightly basis. The science goals of these observations are to: 1) obtain coverage of the early phases of SN emission (to study the outer layers of the SN ejecta), and 2) to obtain well-sampled light curves of SNe Ia. (Towards calibrating the luminosity-width relation.)

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