IMACS CCD Mosaic Camera

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CCD TEST RESULTS

Camera detectors:

• 8 SITe ST-002A 2K x 4K pixel, back illuminated CCD's (shared lot order with NOAO)

• 2 (Loral) 2.6K x 512 pixel front illuminated CCD's for flexure control

Science and flexure CCD electronics:

• 6 board design:

• IMACS control electronics consists of:

- preamp, clock and DC filters in dewar
- science saddlebag with power (1 card), bias (4 cards), DSP (1 card), and signal processing (4 cards)
- 1 PCI computer interface card, fiber communications with saddlebag

CCD TEST RESULTS

• flexure ("wing chip") control electronics consist of:
- preamp, clock and DC filters in dewar
- wing chip saddlebag with one each of power, bias, DSP, and signal processing cards
- 1 PCI computer interface card, fiber communications with saddlebag

Guider cameras

• Magellan design, see http://www.ociw.edu/~burley/ccd/guider.html for all design information. Design was the testbed for the science control electronics

Noise performance:

• single chip read noise 3.5 e- for 10 us pixel times (measured for two CCD's in MIKE spectrograph)

CCD TEST RESULTS

• array read noise 4.8 e- for 10 us pixel time (estimate, non-optimized)
• SITE spec read noise 4.5e- (min) 5.2e-(typ) 6.5e-(max) at 20us per pixel
• no sign of cross-talk between channels

CCD cosmetics:
• no outstanding cosmetic problems
• AR coating pinholes on some chips (10--15% effect)
• worst chip has a few bad columns

Flatness:
• individual chip flatness typical 10 um peak-to-valley
• worst individual chip 13 um p-v
• array flatness 30 um p-v [spec 40um, goal 15um p-v]
• long camera images are 1.7 pixels FWHM

CCD TEST RESULTS

CCD gaps + alignment geometry:

- CCD gaps are 970 um (estimate) [spec 1000 um, goal 500 um]
- CCD (mis)alignment +/- 0.5 pixels [spec +/- 5 pixels, goal +/- 0.5 pixels]

Temperature control:
- dual cryotigers working OK, cool-down time is 4 hours
- nominal operating temperature is -110 C
- warmest chips are -112 C (with no heater current, dewar at 20 C)
- coldest chips are -115 C

Focus stage:
- stroke is +/- 0.8mm [spec +/- 1.0mm, goal +/- 2.0mm]

Piezo stage:
- stroke is +/- 100um [spec +/- 75um, goal +/- 150um]
- nominal operating temperature 0 C

CCD TEST RESULTS

ITEMS TO WORRY ABOUT

1. Array flatness

- are all the ccds in focus for both long camera and short camera?
- is the array flat enough at operating temperature? (long camera test images are OK)
- are the wing chips co-planar with the science chips? ("first light" images are OK)]

2. *Image wings up to 3 pixels in "x" direction*

- total flux below 0.001 mag level
- appears to be a property of the ccd, possible internal scattering at long wavelengths
- shows up with clear spectroscopic filter, but not in B, V or R filters
- mild effect in I, obvious in Z filter
- no action

CCD TEST RESULTS

ITEMS TO WORRY ABOUT

3. *Wing chips are barely functioning*

- poor horizontal CTE, only 2/3 of best two chips usable
- plan to replace wing chips with same design made on modern process
- trading favours with Dick Bredthauer and/or Mike Lesser

4. *focus stage collar slippage*

- connection from focus stage motor to gear shaft relies on a collar held with a set-screw – slippage possible
- no plan yet

CCD TEST RESULTS

ITEMS TO WORRY ABOUT

5. operating temperature

- vacuum pressure increases after a few days, temperature of ccds steadily increases a few deg C
- ran approximately 12 days continuously with T<-100 C on all chips
- plan to extensively clean and pump dewar, potential problem is self-correcting with enough pumping

6. *window coating is not exactly waterproof*

- potential damage to window coating from condensation
- appears to occur when the dewar is warmed up
- dewar needs to be pumped when warming up, what about power failures?
- continuous dry N2 flow in window area desirable

CCD TEST RESULTS

ITEMS TO WORRY ABOUT

7. cryotiger long-term reliability

- potential problem with contamination of gas lines each time the dewar is disconnected (i.e. each dewar move between f/4 and f/2 camera position)
- potential gas-leak failures
- plan is to keep gas recharge kit at LCO, as well as spare cold head

8. optical link errors

- re-design of optical link finished, retrofit when ready (August)

9. bias jumps in images

- software fix in progress

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ITEMS TO WORRY ABOUT

10. electronics box thermal properties

- CCD controller electronics generate about 50W
- plan to remove heat with water cooling (no fan), requires testing

11. training of mountain support staff

- science electronics are a copy of those for the two cameras on MIKE spectrograph, and will be used on all Carnegie CCD cameras in near future (Magellan echellette, Butler/Shectman PlanetSpectrograph, LDSS2 upgrade, upgrades to existing CCD cameras for du Pont and Swope telescopes)
- some experience with MIKE setup and support
- preliminary training for support of Magellan guider cameras

CCD TEST RESULTS

ITEMS TO WORRY ABOUT

11. training of mountain support staff (cont.)

- spare computer to be installed at each telescope
- spare controller boards to be supplied
- full documentation to be provided
- have started to establish lab/testing facility in astronomer support building

12. documentation + web site

- in progress

13. Spare CCDs

- we received 11 chips, 2 are in MIKE, 8 in IMACS, and the one spare has severe horizontal charge transfer problems (with a minimal amount of debugging effort). We expect two Lincoln Labs CCD's for MIKE, this will free up 2 spares for IMACS

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INTERFACE ISSUES

1. software for correction of flexure

- reduce wing chip image data, centroid, drive piezo-stage
  – in progress

2. stray light

- does the dewar stay dark enough to take dark frames?
- possible light leaks may need to be addressed