90prime Observers Manual//Revised 04/06/2004//Revised 11/30/2004

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1 Overview

This section will give a brief overview of the system and a table of characteristics.

2 Quick Facts

On each CCD, East is up and North is right. So if you need to move your object left, move it north. Pixel scale is about 0.45 arcsec/pixel.

ccd3 ccd4

ccd1 ccd2

CCD3 has a trap about 2/3 of the way up, about in the middle. Data above the trap are useless.

CCD1 has some weird pixels in upper left.

CCDs 3 and 4 have 1 or two bad columns.

There may be other features to be described later.

As of 3pm on 7Apr04, the best focus for CCD2 isn't the same as for the other CCDs. You may have to ignore the existence of CCD2 for a while, unfortunately. We'll let you know if we can fix focus by tilting the dewar relative to the optics (we do this with the focus actuators, fyi).

Since there's a substantial gutter between ccds, roughly 1000 pixels, you'll likely want to zero your coords somewhere other than the unseen center of the array. You might want to put it on the center of some chip. That said, note that offsetting by TCS keyboard commands wants offsets in hms and dms. If you paddle over, you can read off the offsets in arcsec,

The full well of the CCDs is low, about 70k electrons, or about 35k ADU. The last measured values are: Amp 1: 1.78 e/DN Amp 2: 1.81 e/DN Amp 3: 1.68 e/DN Amp 4: 1.67 e/DN Amp 5: 1.71 e/DN Amp 6: 1.72 e/DN Amp 7: 1.62 e/DN Amp 8: 1.71 e/DN

3 Start-Up Instructions

90prime gui (on the linux box STJUKSHON) startup/usage instructions

1) There is a set of mounting and testing instructions that in principle exists. So this manual starts from the successful mounting of the instrument.

2) Filters- Only Gary Rosenbaum is authorized to put filters into filter holders. I reiterate, the only person to touch raw glass is Gary Rosenbaum. the only person to clean filters is Gary Rosenbaum. The only person to remove filters from filter holders is Gary rosenbaum.

Got it? Only Gary Rosenbaum will handle filters. Plan ahead.

We now have a whole bunch of 6" holders, into which the existing 90prime-owned filters will be permanently mounted. We need to make a holder-box for the filters-plus-holders.

Once filters are permanently mounted, Bill Wood will be allowed to remove holders from the instrument and install new ones. Things should be relatively safe once filters are permanently mounted. Observers CANNOT add/remove filters from the instrument even after they're mounted in holders.

3) Nitrogen filling- The operator will fill the dewar once per day. Hold time is longer than 2 nights, but the change in weight as nitrogen boils off will unbalance the telescope if it isn't filled daily.

4) Starting the 90prime Instrument gui and running the gui

Double click on the icon "90prime Instrument GUI" The control interface will come up running (in older versions you had to make it run).

You'll see a bunch of lights and 4 tabs- Focus, Filter Wheel, Guide Camera, and Misc.

For now, you need to type the follwoing command into a xterm window, "dataserver". This command now works as of 7Apr04, but apparently one can go back to the old way if it fails. It will require a phonecall to go back to the old way. This command sets up the way we transfer data from the CCD computer (running WINDOWS) to STJUKSHON (this computer, running

LINUX). It also sets up a DS9 display for quick look. You'll want to use "mscdisplay" for real analysis like "imexamine".

4 Instrument Control

We'll now quickly go through the tabs:

THE FOCUS TAB

On startup, you'll see three LVDT readings, one for each focus actuator. Usually you'll see the last digit change by one. That's insurance that things are actually running. The LVDTs give an absolute reference frame.

Now we'll explain the buttons one by one:

a) Focus- this actively moves the three focus actuators a predefined amount. the predefined amount is set by typing a number of encoder steps (as opposed to LVDT increments) into the steps windows. If the "link" button is on, you only type into B, and that same number appears in A and C. That's the mode you'll use.

Do hit a carriage return.

The gui also converts encoder steps into microns, and keeps track of total steps.

Actual focussing is done using the CCD control software. The software will take an exposure, close the shutter, shift charge, change the focus, opern the shutter, etc, and then finally readout.

We have aligned the focal plane of the CCDs as best we can with the focal plane of the optics. If you move actuators A B C different amounts, you've destroyed this work.

For reference, in January 2004, good focus was A=2.237, B=2.217, C=2.309. While the value will change (It should go down xxx as the temperature goes up), the offsets between the three actuators should not change. So check that these offsets are about right, and if they aren't, you should look for a note or you should make a phonecall to see if there was an update or if the previous observer screwed up.

You can keep track of the focus by clicking on the button SET REFERENCES.

b) SET REFERENCES

We jsut discussed it above.

c) TWEAK FOCUS

The instrument flexes. That's bad. The LVDTs allow us to monitor that flexure. TWEAK FOCUS unflexes the telescope by driving the LVDTs back to their reference values. So after a focus run, do click on SET REFERENCES.

To reiterate, you've just gotten into perfect focus. We'd like to believe that if you move to somewhere else in the sky, all that changes is because of instrument flexure. To first order, we can remove that change by hitting TWEAK FOCUS. Of course, the telescope itself flexes too, and perhaps the optics assembly itself flexes. At this point, we are pretty convinced that most problems you'll encounter will be fixed by TWEAK FOCUS and/or a focus run.

DO NOT change individual actuators. It's currently a real pain to align the focal plane. If you want to help us write software to align the focal plane quickly, we'd be grateful for your help.

d) ZERO TOTALS

It zeros out the totals windows.

e) ZERO ENCODERS

It zeros the encoder windows.

THE FILTER WHEEL TAB

Since this part of the gui was written, our way of intereacting with it has been modified to make it better.

So ,let's start by clicking on CONTROL. That will bring up a popup that you'll leave running at all times. So move the popup to a favorite place.

Many of the commands in the main tab are repeated in the popup. Ignore the ones in the main tab, use the popup.

Therefore, aside from some reassuring lights, here is a list of the only buttons you'll push in the main FILTER WHEEL tab: CONTROL (we've already talked about the fact that it brings up a super useful popup) POPULATE WINDOW - this allows Gary Rosenbaum to put filters into the instrument. ROTATION OFF (and ON)- this might be used in an emergency, as would be explained to you by one of us.

So, the rest of this section will explain the "90prime Filter Wheel Control" popup:

INIT FILTER WHEEL- this is done right after Gary Rosenbaum loads filters, or after a power failure. Basically, the filter wheel is spun around once, stopping momentarily to read the tabs in each filter holder. The computer then knows the filter number in each filter position (filter number refers to the filter holder whereas filter position is one of six slots in the filter wheel).

READ FILTERS- There's a file on this computer, at /home/bokobs/90prime/galil/filters.txt that contains the transformation between filter position and filter name. This file is edited by the Gary Rosenbaum. Hitting READ FILTERS applies this program. Now you know the real names of your filters.

SLIDE- our filter wheel works by rotating into position, then sliding the filter in. So we CHANGE FILTERS, then SLIDE. SLIDING is controlled with an in/out toggle. When a filter is in the beam, the CHANGE FILTERS button is disabled so that you can't rotate with a filter in the beam.

now CHANGE FILTERS- assuming you have no filter in the beam, you can set the filter name in the window, and then hit CHANGE FILTERS

CLOSE closes this popup

STOP RUNNING You'll almost never be instructed to push this button

THE GUIDE CAMERA TAB

Focussing is now done at the TCS console by the operator. You'll have to INITIALIZE and CHANGE guide FILTER (guide filter is different from science filter, guider light is picked off before science filter)

We've provided a few 1" round filters for now in the guider: 1) blank/clear 2) RED 3) neutral density 4) blank 5) green 6) blue

We don't have much experience for how much guiding with the 'correct filter' matters.

The guide camera is at a fixed location. It's fed by a pickoff mirror. If you don't have guide stars, your only choices are to increase the guider exposure time or to move the telescope a bit. The guider field is roughly 4x4 arcmin. The telescope field is roughly 60x60 arcmin, with roughly 10 arcmin gutters between CCDs.

From pixel (3993,3868), roughly, on CCD1 (lower left CCD in the mosaic), one offsets 328 arcsec WEST and 3123 arcsec NORTH to center that star on the guider. This is just a useful fact.

MISC.

At this point, these are potential commands that'll only be used by you at Grant's command.

5 CCD Control

The CCD (on rack mounted BOKCCD2) computer

This is a machine running WINDOWS. It talks to the CCD controller. While it is in principle a stand-alone machine, we use it to run the data-taking gui and to ship data to STJUKSHON.

Mike Lesser has a prototype version of the LABVIEW executable (LABVIEW is what makes the guis for us) that will run in linux, thus allowing the gui to appear on stjukshon, thus making it easier for one person to observe. This version is not totally tested. We'll let you know when it appears.

If you turn the machine or or reboot it, the 90PrimeAzCamServer will come up automatically. Yuo can minimize it.

Then double click on AzCamTool icon in upper right. It'll load a bunch of stuff and be running. This is what you need to take data.

You'll need to set some parameters (ps: there's a longer version on the 90prime site at compton.as.arizona.edu/90prime)

1) Click on Detector. It'll say 4096x4096, binned 1x1, with 40 cols of overscan per ccd. You'll not have to change this, so hit cancel (clearly if you do make changes, hit 'apply")

2) RESET button resets the controller. It might sometime be needed.

3) PREFERENCES has a bunch of flags. The only one you might want to check that's not already checked is "Prompt for Image Title"

4) click on FILENAME button. Here's where you set where on STJUKSHON the data will end up. You'll also control rootnames and sequence numbers and several automatic aspects of naming here.

5) Save Image should always be on

6) You can type into anything yellow. Be careful not to mess with binning, you could waste a lot of time if you change that and forget.

7) there's a MODE information window: you'll see IDLE, PREPARING, EXPOSING, READOUT, CREATING. The last one means that the readout stream is being properly assembled and shipped.

8) There are many other features: Imagetype, expose/pause, sequence, testimage, title, exposure time. With luck these will quickly be self evident.

9) Lots of other abilities I haven't described (for instance RUN SCRIPT), partly because these abilities are new and/or not completely tested, or because edo doesn't yet know how they work.

6 Data Archiving

The DDS4 dat drive is called /dev/nst0, or /dev/nst0m for compressed. If you already have compressed data, this compression will buy you little/nothing.

There's a dvd reader/writer. You can use DVDRECORD or XCDROAST. Neil Lauver is the only one we know who's successfully written DVDs. We'll add more later.

There's also scp to downtown or to your laptop.

There's also a USB option, plug it in. The mountpoint is /mnt/diskonkey so say cp *.fits.gz . or some such command, but you know that.

STEWARD MAKES NO AUTOMATIC ARCHIVES OF ANY SORT. IT'S UP TO YOU. [we have chatted with noao about becoming part of their automatic archive, but this is far from coming to pass.]

7 Calibration Images

Flatfields, fringing and the like

When we conceived of 90prime, we assumed flats would be twilight or dark sky flats. We are slowly trying to make working dome flats since the weather often won't cooperate.

Note that the operators work from 0.5 hours after sunset to 0.5 hours before sunrise. This is not ideal for flats. With other instruments, the observer makes a deal with the operator to come early and go home early. If taking only eveing flats, say, is insufficient, write a polite note in the trouble report. Bob Peterson and Paul Smith and Bill Wood are aware that some changes may need to be made. Exactly what those changes could be is unclear.

As of April 7, 2004, the flatfield lamps are still uneven with specular reflections. My guess is that right now they're not useful. We're working SLOWLY on the problem.

There are fringes in the redder passbands. You need to take the proper data to make fringe frames. We'll see if we can make a library of fringe frames.

QE curve is found at `adansonia.as.arizona.edu/~edo/90prime1_qe.pdf`

CCD layout is found at `http://compton.as.arizona.edu/90prime/docs/CCDconfig.ps`

8 Filters

Windhorst filter curves are found at http://www.noao.edu/noao/mosaic/filters.html click on "click here" these are 5.75" square filters some vignetting occurs

90prime owns 13 6" square filters Bessell U B V R I SDSS u' g' r' i' z' Washington C M DDO51 Note that Olszewski bought 4, Olszewski/Bechtold bought 1 or 2, NAU bought1, 90" bought 1, Xiaohui Fan bought 4.