

DBSP Observing Manual

I. Arcavi, P. Bilgi, N.Blagorodnova, K.Burdge, A.Y.Q.Ho

May 7, 2018

Contents

1 Remote Computer Access	2
2 Setup	2
3 Wavelength coverage check	2
4 Instrument focus	3
5 Calibrations	3
5.1 Bias frames	3
5.2 Arc-lamps	4
5.3 Flat frames	4
6 Getting started on science objects	4
7 Science objects	5
8 Data transfer	6
A Appendix - Spectral atlas plots	7

1 Remote Computer Access

- Find out what time sunrise and sunset is from your favorite ephemeris catalogs on the Internet. Then add or subtract 48 minutes to find the times of 12 degree twilight. Alternatively, check [urlhttp://www.palomar.caltech.edu/calendar.tcl](http://www.palomar.caltech.edu/calendar.tcl).
- If not observing remotely one should budget at least two hours to get to the Palomar observatory. The Dome is made dark by 4pm in the Summer and 3:30pm in the Winter.
- If observing remotely, login to the remote machine. Username and password can be found in the handbook in the observing room (or you can ask the telescope operator).
Double click the shortcut to the DBSP VNC sessions which will give you to the GUI operating DBSP on the `instrument 7` machine (see the diagram in Figure 1).
- On the left of the three screens should be a shortcut named `Instrument 7`. This opens the VNC session to the machine running the DBSP GUI. The password for access can be found in the handbook in the observing room, or you can ask the telescope operator.
- The middle screen has DS9 and IRAF sessions running.
- The right screen shows a VNC session to the FacSum (facility summary) machine.

2 Setup

When submitting the online setup, use the following configuration.

Object	Setting
# of slits	Single
Dichroic	D-55
Polarimeter	None
Blue grating	600/4000
Blue angle	27°17'
Red grating	316/7500
Red angle	24°38.2'

Table 1: Usual ZTF setup.

3 Wavelength coverage check

Check if the spectral wavelength coverage is as expected and ensure overlap between the two cameras. On the blue side, this will be from around 290nm to 590nm and on the red, 435nm to 1065nm. The D-55 dichroic however will limit both sides to/from 550nm respectively.

IMPORTANT – clear both chips by doing a couple of test exposures before beginning the run. Frequently, the TO will have already taken a few of these in the afternoon.

Change the turret setting (center grey window on left monitor) to `lamps` and turn on the internal arc lamps. He+Ne+Ar works best for the red side and Fe+Ar for the blue (bear in mind that the Fe+Ar lamp takes a minute to warm up). Perform the exposures listed below with the given slit

widths. Usually just the one set with 0.5 is fine, but it is ideal to use all three. Note that the blue chip is vertical and the red chip is horizontal.

When checking exposures in the terminal, and subsequently removing test arcs, use "del" instead of "rm."

	0.5	1	1.5
Red	0.4 sec	0.2 sec	0.1 sec
Blue	10 sec	5 sec	3 sec

Table 2: Recommended arc exposure times.

The resulting spectra can be cross-checked with the NOAO spectral atlas. The He+Ne+Ar and Fe+Ar arc lamp spectra have been downloaded from the NOAO website. You can find the spectral atlas plot in Figures 2 and 3 in the Appendix of this document.

- Open a local IRAF session on the observer1 machine or by clicking the "IRAF Spectral Atlas" icon on the desktop (middle monitor).
- Enter `onedspec` at the prompt to run the necessary package.
- Enter `epar splot` to edit the `splot` parameters. Change the `xmin` and `xmax` values to match the blue side wavelength range.
- To adjust the plot dimensions, place the cursor over the desired bottom left corner and press "e", then place the cursor over the desired top right corner and press e again.
- Repeat the process for the red side using the `henear.fits` file. Find the wavelength solution and ensure the coverage is as expected and that there is an overlap of around 20nm.

4 Instrument focus

Select the 0.5 slit and take the same arc-lamp exposures as before. It is desired to measure the FWHM of four spectral lines in roughly four equally spaced locations along the direction of dispersion from end to end.

With the data FITS file open in DS9, run the IMEXAM utility from the IRAF terminal. To find the FWHM place the cursor in the center of a spectral line and press j to acquire a profile in the x-direction and k in the y-direction. Make a note of the focal setting and the FWHM measurements. Ask the TO to go to the cage and change the focal setting (usually by 20 in either direction).

Repeat the measurements with the new focal setting for the same spectral lines. Find the focal setting with the minimum overall FWHM and ask the TO to lock it there. For example, Table 3 shows a possible focus table for the red side.

5 Calibrations

5.1 Bias frames

Turn off the arc lamps (by pressing green circles next to them), switch the turret setting to "Closed" and take a sequence of ten bias exposures. Set the exposure time to zero, adjust the image number

Pixel	Focal setting			
	880	860	870	890
980	3.39	3.01	3.11	3.33
1742	2.54	2.80	2.66	2.47
2051	2.55	3.12	2.82	2.37
3304	2.28	2.22	2.22	2.39

Table 3: The last column offers the overall best focus.

to 10 and edit the object name and type accordingly. Note that when typing values on the blue and red side controls, it is important to hit enter to ensure the values register.

5.2 Arc-lamps

Put the lamps back on, switch the turret setting to “Lamps” and take two sets of the following exposures: He+Ne+Ar lamp on the red side for 0.4 seconds and Fe+Ar lamp on the blue side for 60 seconds.

5.3 Flat frames

Switch the turret setting to “Aperture” and check with the TO that it is okay to remove the mirror cover. Turn on the high lamps and then take flat frame exposures with the slit width(s) that will most likely be used for the night based on the estimated seeing (ask the TO).

Typically 60 seconds on the red side and 90 seconds on the blue side generate dome flat frames with an acceptable number of counts.

Note:

Red camera – 4k × 2k CCD linear to 40000 DN, saturation at 45000 DN.

Blue camera – 2k × 4k CCD linear to 62000 DN, saturation at 65000 DN.

6 Getting started on science objects

- **Star-list:** The star-list can be retrieved from the relevant page on the Marshall where targets are assigned for a particular run. Use SCP to copy the star-list text file to the local computer [user1@observer1.palomar.caltech.edu:/observer/observer/targets/username/]. Ask the support astronomer for the password. Load it into the star-list program on the right screen. Sort the targets by RA to aid in the scheduling process. The starlist is in the following sample format to be parsed by the FacSum machine program:

```
14 gjt                00 18 39.64  +02 11 03.5   2000.0   !   c o m m e n t
```

- **Sky focus:** Once the dome is open, the TO will do a sky focus. Ask for the seeing and choose the appropriate slit width for observations. Keep an eye on the seeing during the night and change the slit width accordingly. This can be monitored at the Palomar maintenance page: www.palomar.caltech.edu/maintenance/index.tcl.

- **Standard star measurements:** Change the turret setting to “Aperture”. At the onset of 12 degree twilight, take two one-minute exposures of one of the standard stars from Table 6.

Star	RA	Dec	Epoch
G191B2B (blue)	05 05 30.6	+52 49 56.0	2000.0
Feige34 (red)	10 39 36.71	+43 06 10.1	2000.0
BD+28d4211 (blue)	21 51 11.07	+28 51 51.8	2000.0

Column 211 on the blue chip is a bad column so make sure that the trace is far enough away from there. If switching slits during the night ensure that standard star measurements are made with all slits used.

- Open the viewer to the slit viewing camera. On the computer to the right there will be a shortcut that opens a VNC session to the computer that is running the slit viewing camera.

7 Science objects

- Ask the TO to use the parallactic angle for all measurements unless otherwise required. It is best to cover targets in order of RA. Depending on the viewing conditions, the maximum acceptable air-mass should be between 1.5 and 2.
- A target is communicated to the TO by highlighting it in the target list on the FacSum machine and clicking Load to Telescope. Help the TO identify the target in the slit viewing camera (which will most likely be FLI) so that it can be positioned on the slit.
- If the target is too faint to be detected on the slit viewing camera, it may be necessary to use blind offsets. The two ways to do this are, 1) Go directly to an offset star by having it in the target list and loading it to the telescope. Once positioned, read out the offset coordinates of the target to the TO. 2) From the position of where the target is expected to be, read out the offset coordinates of the offset-star from the target. Once the offset star is positioned in the slit, ask the TO to reverse the offset coordinates to return to the target.
- Finding charts and offset coordinates can be found at any targets homepage at the ZTF transient or galactic marshal websites <http://skipper.caltech.edu:8080/cgi-bin/growth/marshal.cgi>. Alternatively, you can use Nadia’s script¹ which uses the Pan-STARRS catalogue to find the offset stars and plot the finder.
- Check the quality of the trace after each exposure. The minimum acceptable S/N for a given target is usually 5. A good rule of thumb for deciding exposure time is the 20-20 rule. That is to say that a 20th magnitude object requires a 20 minute exposure to achieve a decent S/N.

Note: There is software on the observer1 machine to get a quick look at reduced spectroscopic data on the fly. This software does background subtraction and source extraction. Open a terminal on observer1 and type in `dbsp_drp`. This should open Jennifer Milburns quick look software for which the manual is at www.astro.caltech.edu/palomar/observer/software/drp.html.

¹Download from here: https://github.com/nblago/utils/blob/master/finder_chart_ps1.py.

Use as: `python finder_chart_ps1.py [RA] [Dec] [Name] [[rad]] [[telescope]]`

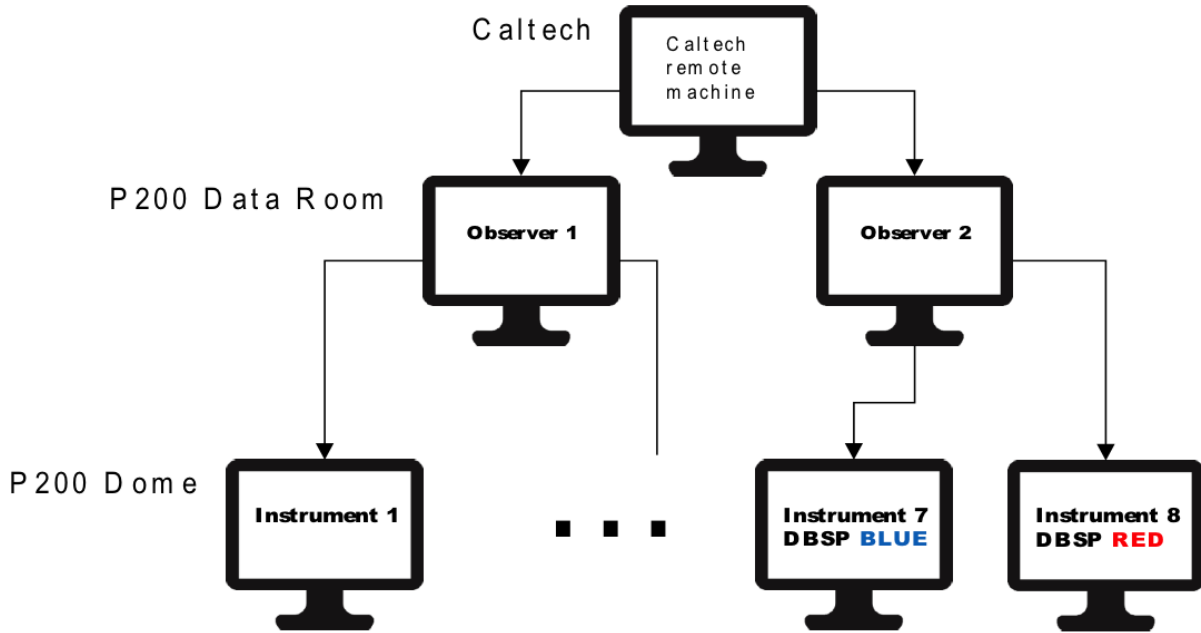


Figure 1: P200 instrument computer network

8 Data transfer

The various instrument computer directories are mounted on the observer1 machine also. Access the DBSP data folder at: [/remote/instrument7/DBSP/date/]. Alternatively you may use rsync to periodically transfer data throughout the night to your location of choice for on-the-fly data reduction.

The remote machine at Caltech connects to either observer 1 or 2 at the P200 data room through a VNC session. Both the observer 1 and 2 machines have three physical desktops at the ports shown in Table 8:

Port number	Observer 1	Observer 2
5900	FacSum display	DBSP control screen
6900	LFC control desktop	FacSum display
7900	LFC IRAF+DS9 sessions	DBSP IRAF+DS9 sessions

The GUI for DBSP is loaded on the `instrument 7` machine (the one for the blue camera). Each instrument computer has three desktops of which the GUI is typically loaded onto that desktop with an access port at 5916. Thus, the DBSP GUI is accessed from the observer computer by initiating a VNC connection to, [instrument7.palomar.caltech.edu:16]. There is a shortcut for this on the DBSP control screen on the observer machine.

A Appendix - Spectral atlas plots

NOAO/IRAF V2.16.1 @tucana.tuc.noao.edu Tue 11:12:37 23-Jun-2015
identify /tmp/104.175.198.46/output30682 - Ap 1
FeAr 3200A

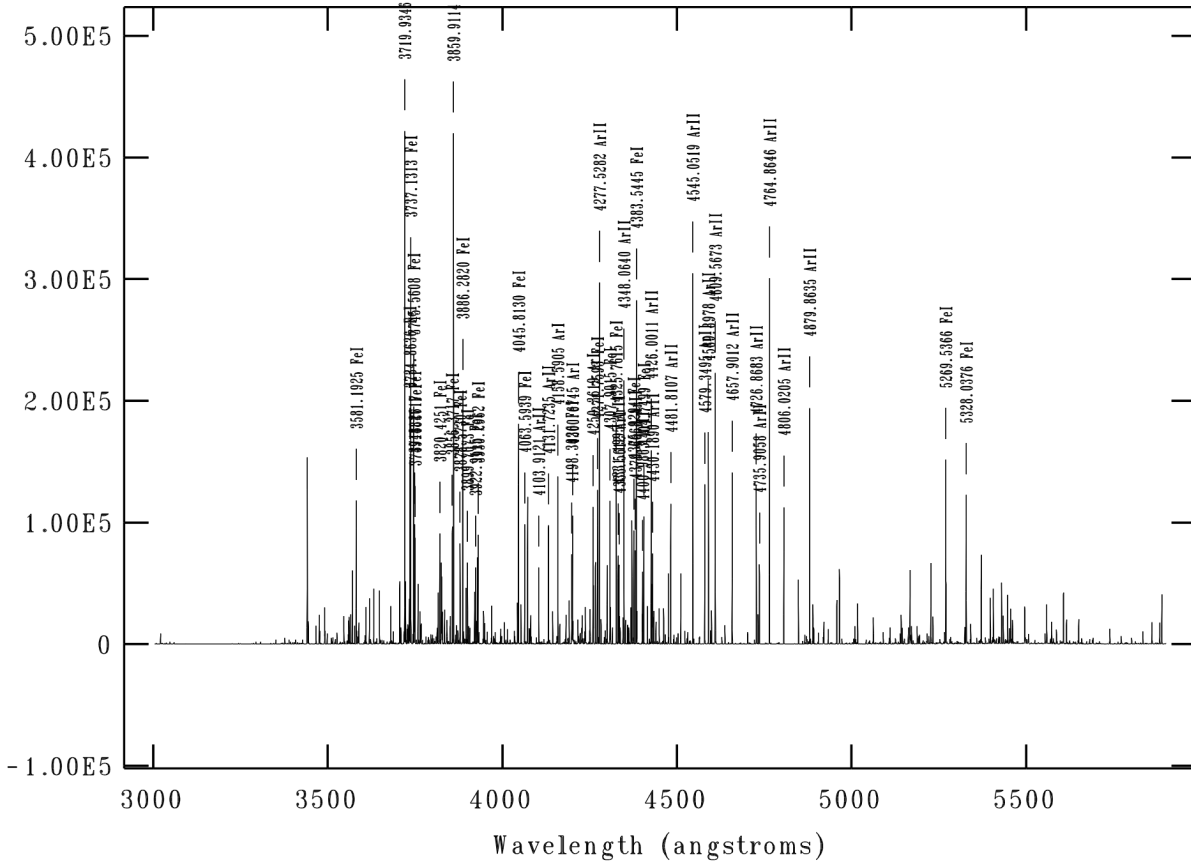


Figure 2: Fe+Ar spectral atlas

NOAO/IRAF V2.16.1 @tucana.tuc.noao.edu Tue 11:14:32 23-Jun-2015
 identify /tmp/104.175.198.46/output30958 - Ap 1
 heneart 3500A

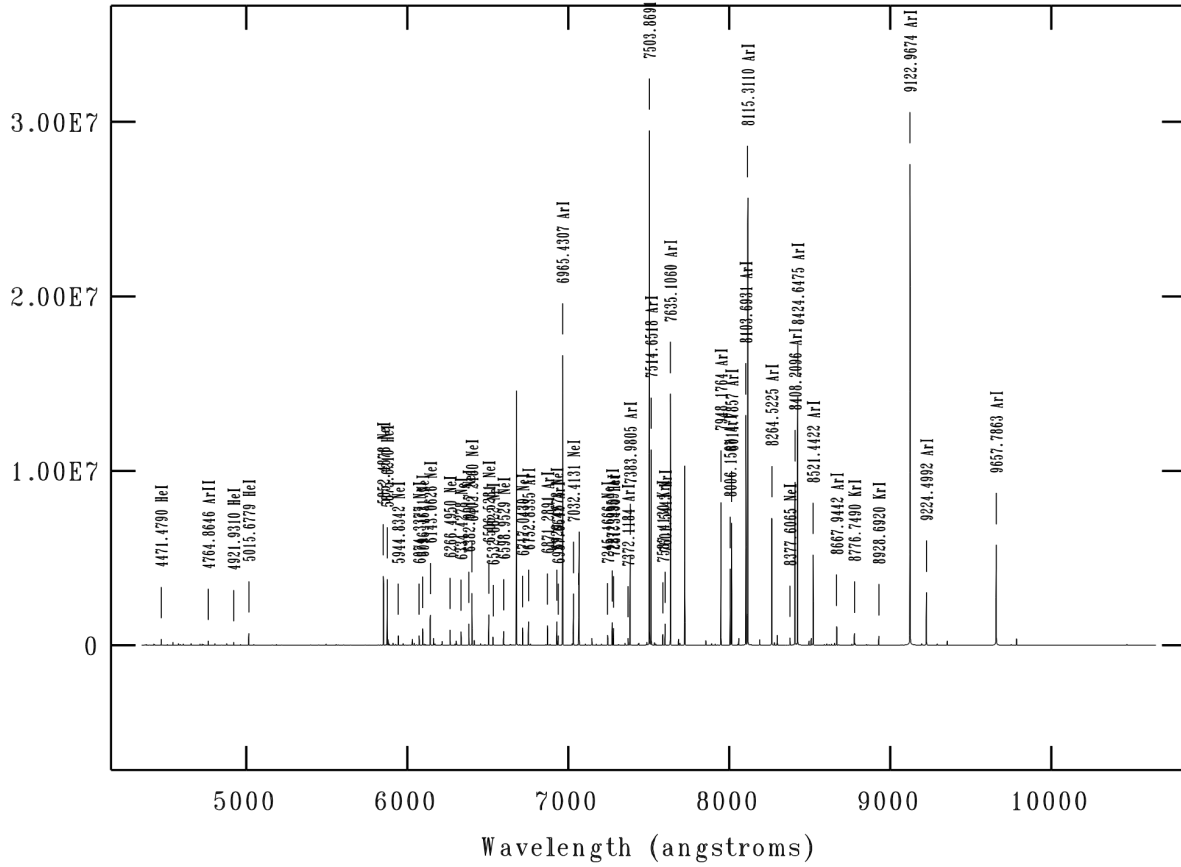


Figure 3: He+Ne+Ar spectral atlas