Taking Data

Logging in to heiles

For all data taking, you will need to be logged in to `heiles` at Leuschner. Unfortunately, the poor computer never got officially named, so you will need to ssh in to `heiles` using its IP address, as shown here:

```
aquarius>/home/yourname% ssh -XY radiolab@leuschner.berkeley.edu -p 31
```

You know the password. Once there, you may create a directory for your group, if you have not already. Once you move in to that directory, you are ready to take data.

Acquiring Spectra in IDL

Since most of the default settings for the spectrometer are appropriate to what you are doing, taking data is pretty straightforward, using `takespec`. You must provide a base filename, and you may also provide the number of files to write, and the number of spectra per file. Presently, the default number of spectra is 256 per file, and the minimum number of spectra per file is three. The way the spectrometer is currently set, a single spectrum takes about one tenth of a second, so 256 spectra means that each file will take about 30 seconds. The default number of files is just one. The following command would then produced a file called 'test0.log' with 256 spectra.

```
IDL> takespec, 'test'
```

The following would produce three files, each with fifty spectra, and named 'test0.log', 'test1.log', and 'test2.log'.

```
IDL> takespec, 'test', numSpec = 50, numFiles = 3
```

These files will be written to whatever directory you are working in on `heiles`, and will overwrite any existing files with those names, so be careful that you do not overwrite your data, or that of another group.

Controlling the LO Frequency

The program which controls the frequency of the local oscillator is `hp_synth`, and simply takes a frequency in MHz and the amplitude in dBm. You'll want to just leave the amplitude at 10 for your observations, as that seems to work well.

```
IDL> freq = 1570
IDL> amp = 10
IDL> hp_synth, freq = freq, amp = amp       ; sets the lo to 1570 MHz
```

If the local oscillator is turned off (that is, is set to a very small amplitude), you will not see any hydrogen regardless of your frequency. Spectra will have some non-zero count in the first few channels, but for the majority of channels in your spectra, there will be nothing. If this starts happening, reset the amplitude of the synthesizer to the suggested value.

Note that the description of the synthesizer control is wrong on the circuit diagram page. Wavetek does not exist any more.

Controlling the Noise Diode

In order to calibrate your spectra, you will need to take some data with the calibration noise on. The procedure for doing this in IDL is straightforward. To turn the noise on:

```
IDL> dish, /noise_on
```

You can probably guess how to turn it off.

```
IDL> dish, /noise_off
```

It is probably a good idea at the start of any observation to rest the current state of the noise diode, since you do not know what state it will have been left in.

Analyzing Spectra

Once you take your data, you will likely want to look at them. You can do this either on `heiles` or on the computers in the lab. This means that you can check your spectra as they are written on `heiles` to make sure your spectra have the features that you expect, and once you feel confident that your data are correct, you can copy all of the files back to the `ugastro` server and do more serious analysis. Note that the computers in the lab will read spectra in much more quickly.

Copying Files

Be sure to keep a careful eye on disk usage at Leuschner. You can use the command:

```
radiolab@Heiles:~> df -kl
```

Check usage on the /home disk. If this is approaching 100%, copy and delete your data.

In order to move files from `heiles` to the `ugastro` server, you will need to use the `scp` command. Type `man scp` at the unix terminal to get more details. The basics are straightforward though. To copy the files written earlier with the 'test' prefix from `heiles` to your data directory on `ugastro` (which we can call `yourdatadir`) while on one of the computers in the lab, use:.

```
aquarius>/home/yourname/yourdatadir% scp -p 31-r radiolab@leuschner.berkeley.edu:spec_data/
uglab/test\*.log .
```

Note that in order to use the wildcard (*) with scp, you need to include a backslash preceding the wildcard.

Reading Spectra in to IDL

The data you take are written to '.log' files which are all in byte format. To get those in to something easy to work with (an array of floating point numbers, for instance), use `readspec`. The returned spectra will be a 2d array, containing a number of 1d spectra. Each spectrum has 8192 channels, and since we decided we wanted fifty spectra per file, we expect that the array should have dimensions 8192x50. Since all of the spectra will be from the same spot in the sky, you will probably just want to total all of the spectra to get a single spectrum for the file.

```
IDL> spec = readspec('test0.log')
IDL> help, spec
SPEC            LONG64    = Array[8192, 49]
IDL> totspec = total(spec, 2)
IDL> help, totspec
TOTSPEC         DOUBLE    = Array[8192]
```

As you can see, the number of spectra in the file is actually one fewer than we specified. This will often be the case. The spectrometer is constantly reading data, and observations may start and end in the middle of spectra. Each spectrum is also made up of a number of packets, which could be dropped as they are passed from the spectrometer to `heiles`. We do not want these incomplete spectra in our final file, so `readspec` drops them, and returns only complete spectra.