Data Reduction/Analysis

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Terminal and Xming (Xquest)

The terminal is where you'll be accessing the data that you will analyze and reduce. For MacOS, this will be done by using the terminal and ssh into the Arecibo computers. For Windows, it's going to be a more difficult task. Mary's instruction on how to use Secure Shell can be found on the UAT APPSS Reduction page. Xming will be used in both Windows and MacOS to display the spectrums.

Basic commands

“ls” - lists files in the current directory you are in

“pwd” - displays current directory

“cd” - changes directory

“mkdir” - creates directory or folder

“rmdir” - removes directory or folder

“mv” - moves designated files

Accessing the data

The data reduction process is a relatively lengthy part of the process, but its very easy to get the hang of. In order to access the data, you will have to use Secure Shell “ssh -X” establish a connection between your computer and Arecibo’s. “a2010@remote.naic.edu” is the address used. After accessing the main computer, one of three (aserv11, aserv21, and galfas1) faster computers are recommended to be used for the data reduction process.

Data reduction process

Once into a faster computer, access the APPSS directory, then your made directory (if not made, use “mkdir”). In here you will store your reduced data. After this, the data reduction process starts. Start up IDL by typing “idl’, then initiate both “@wasinit” and “@lbwinit”. You can now access and display wappfiles to be reduced. The wappfile template will look like this: wappfile=’/share/wappdata.now/wapp.2015MMDD.a2941.****.fits’

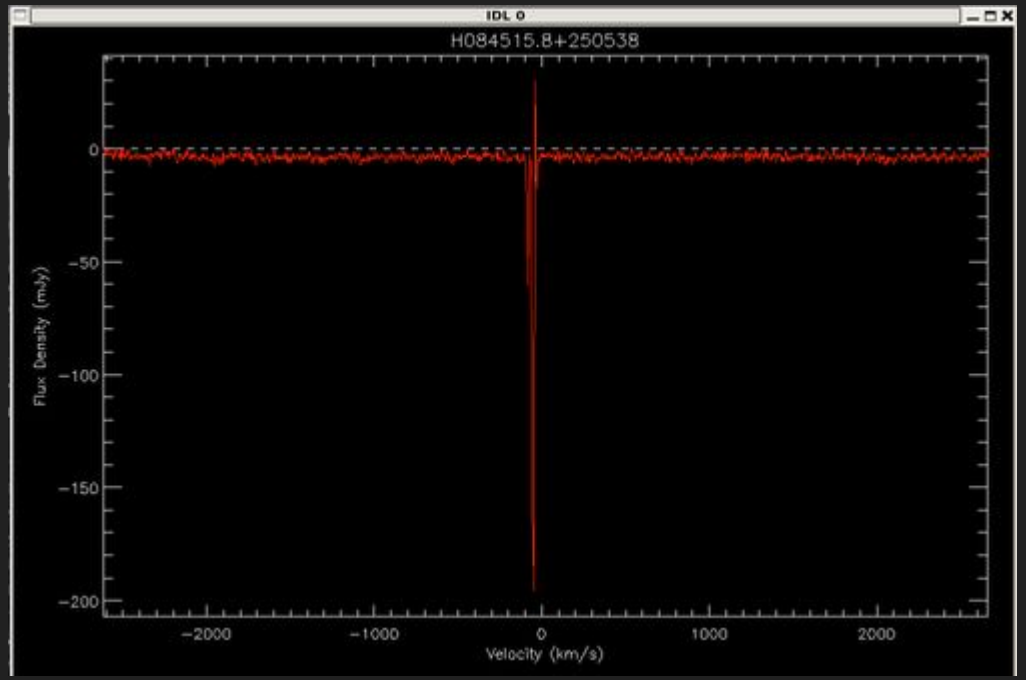
Once you’ve chosen the wappfile from your designated spreadsheet, you will select a board to be looked at.

Data reduction process

IDL> wappfile='/share/wappdata.now/wapp.2015MMDD.a2982.****.fits'
IDL> board = 1
IDL> lbwfromwapps,wappfile,board, lbwsrc
IDL> lbwbaseline, lbwsrc (baselining the source)

IDL> lbwmeasure,lbwsrc (measuring the detection)

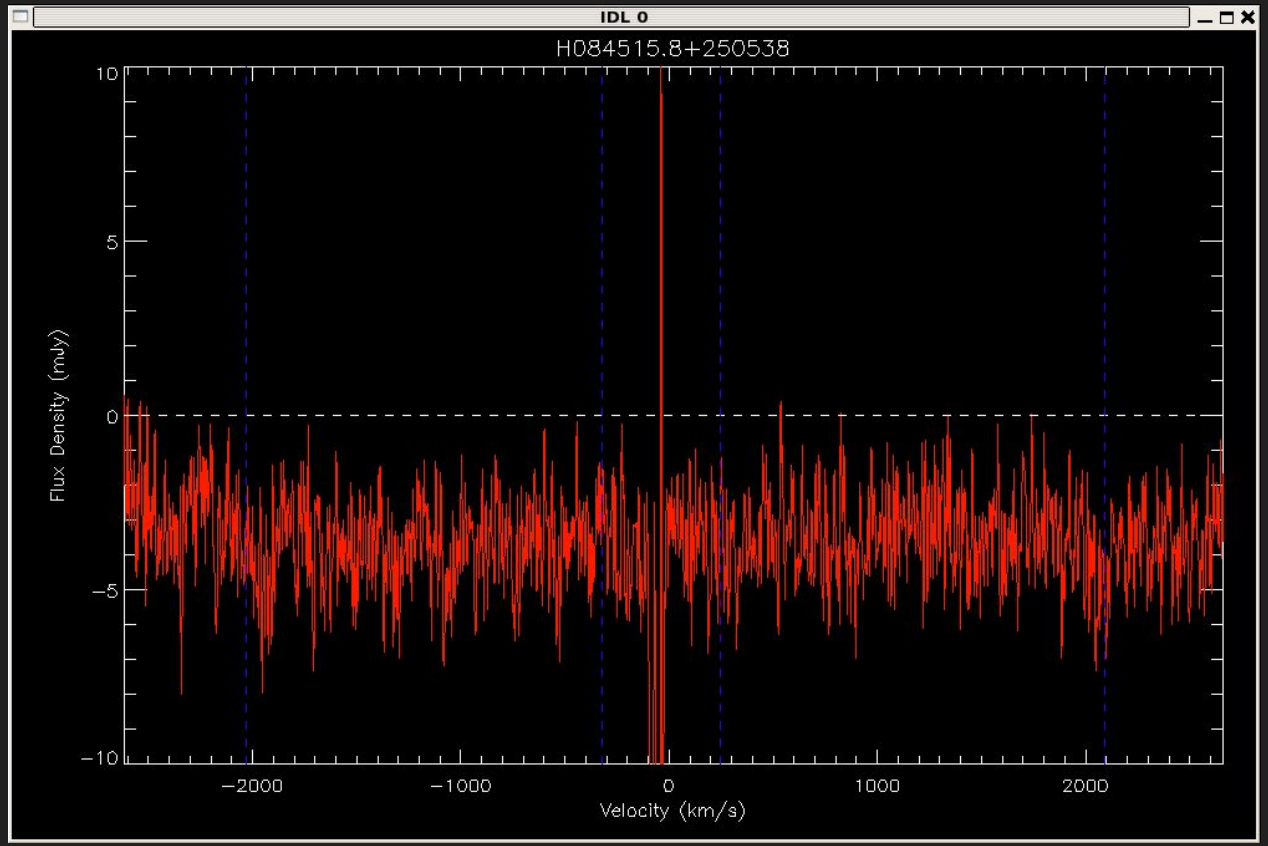
Data reduction process



First board will look like this. Once you've used "lbwmeasure, lbwsrc", you will set a comfortable range to baseline the spectra.

Give [min, max] range to vertically rescale plot.
Press [enter] to accept ranges.

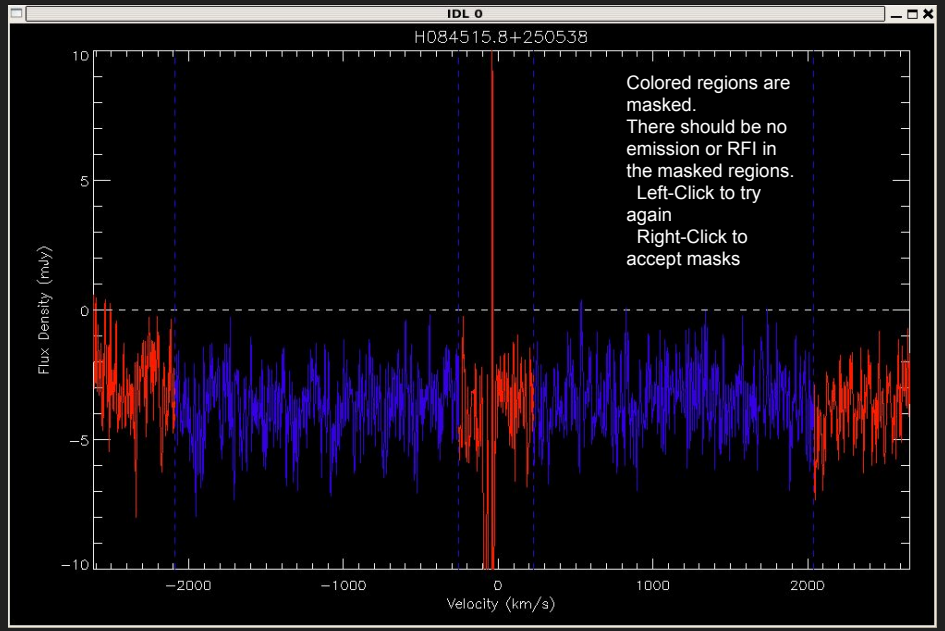
Data reduction process

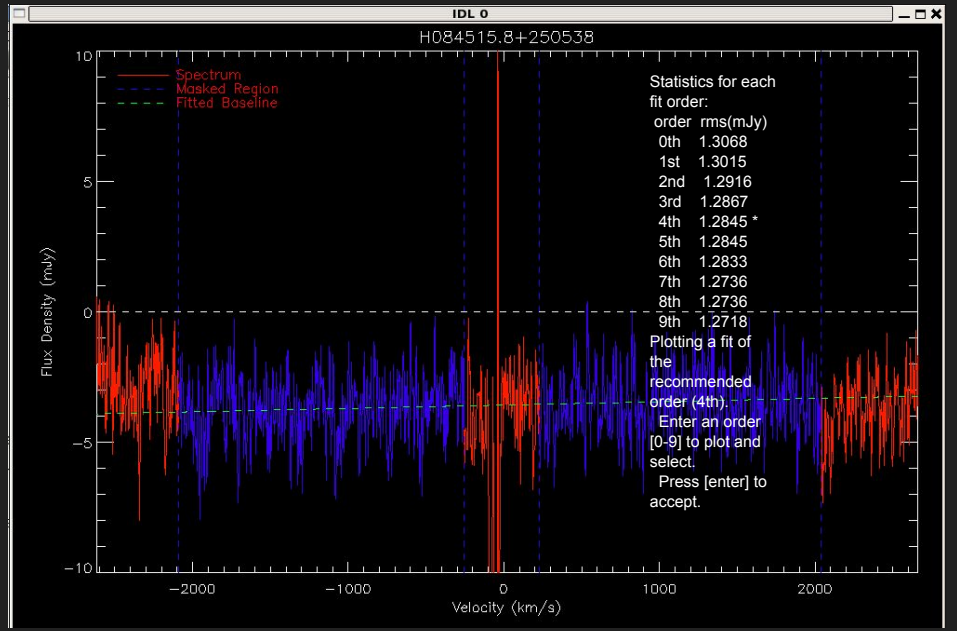


Mark the region(s) without the source or RFI.
Baseline fitting will be performed in these regions.

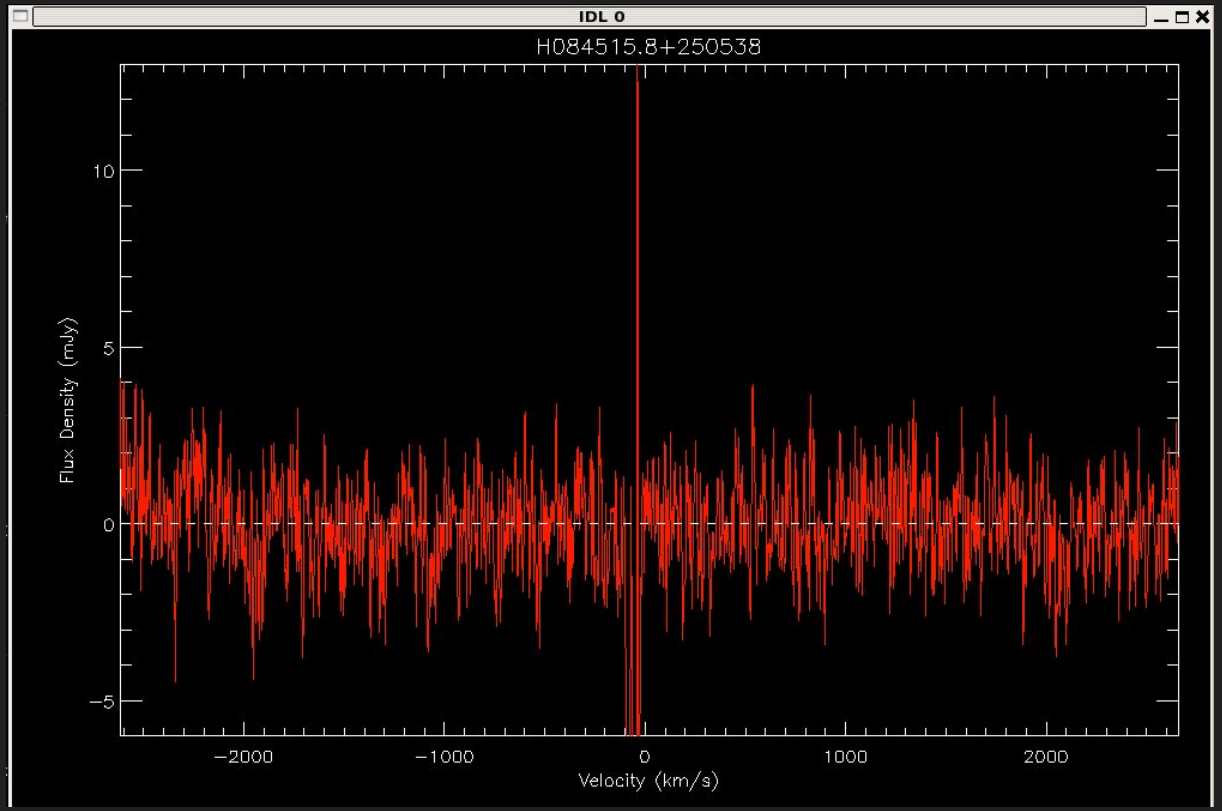
Left-click to add region boundary
Right-click to finish adding regions.

Data reduction process





Data reduction process

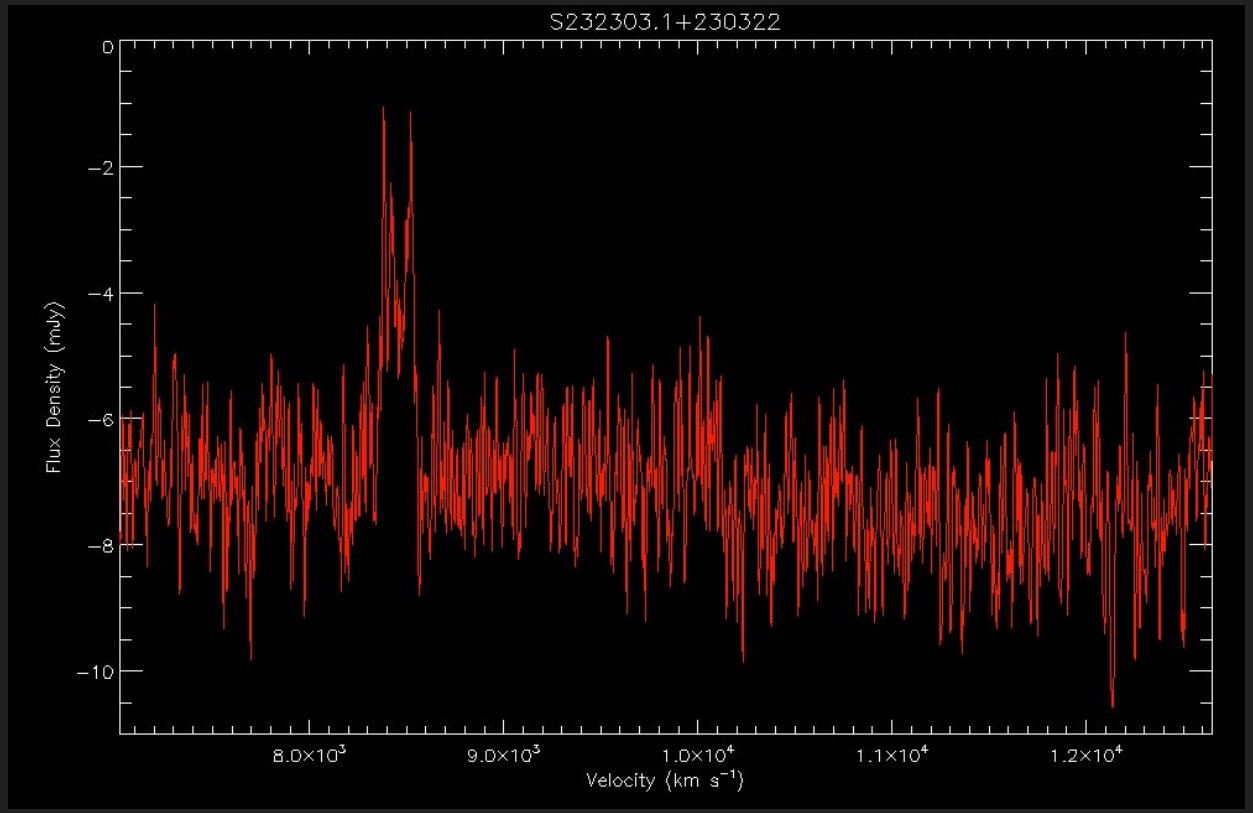


Finished baseline. Once done, the script will give you your final rms and ask you to leave a comment.

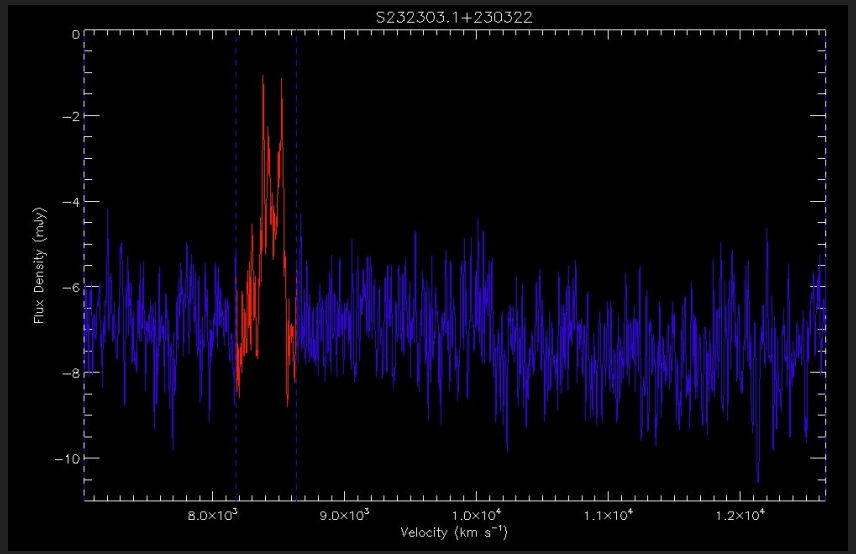
Data reduction process

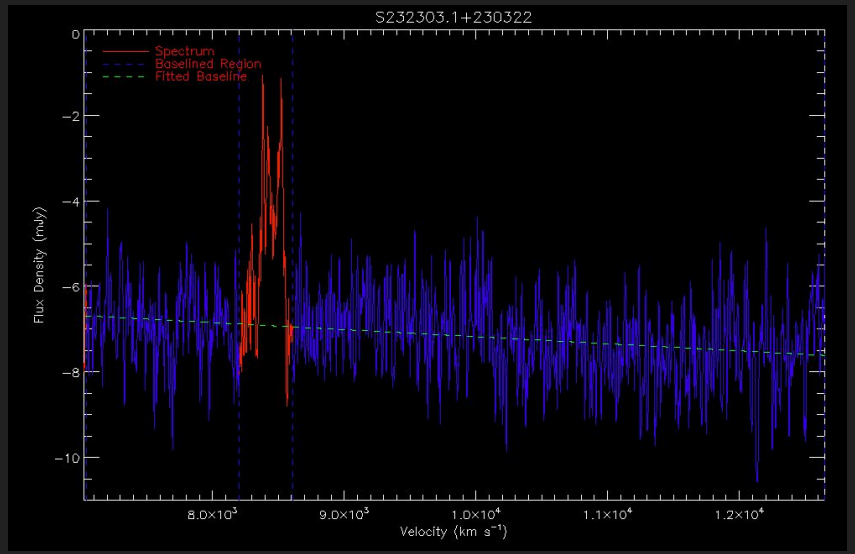
Now to continue to the part of the data reduction process where there is a detection. This part will involve measuring the detected source by using the most appropriate fitting. Double horn fitting for a double peak source, and a gaussian fitting if one peak.

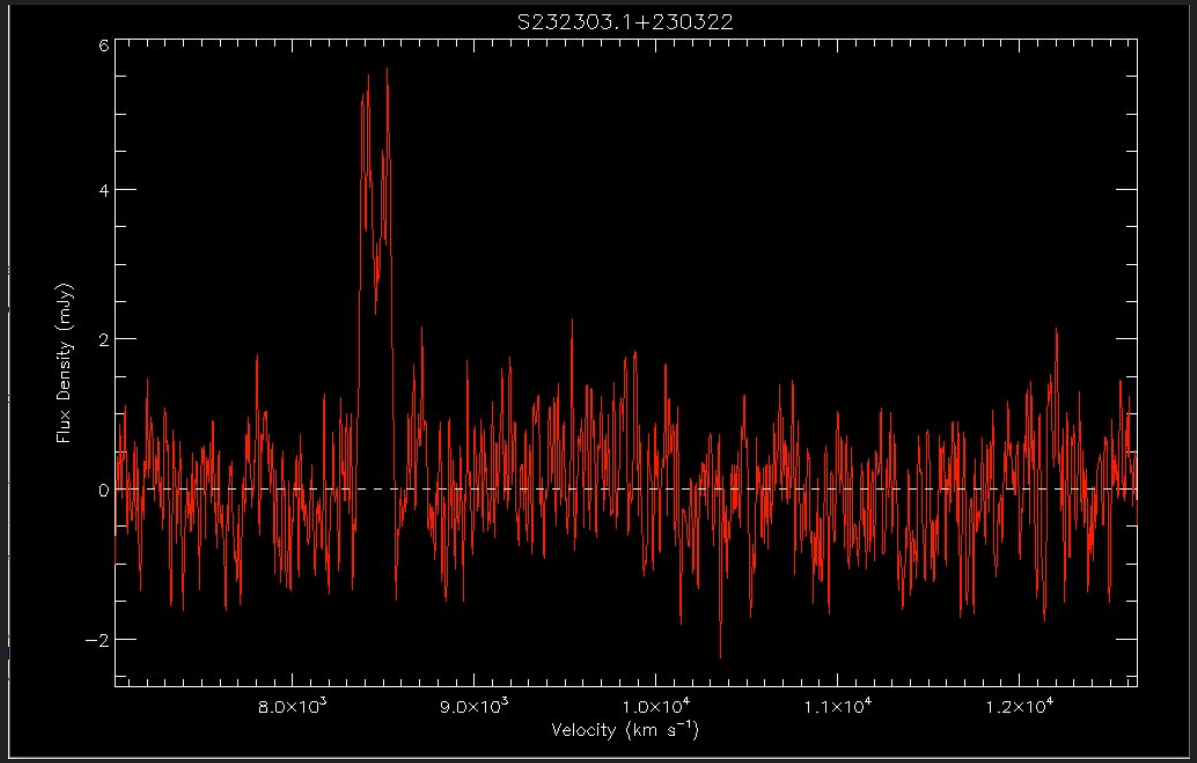
Double horn fitting



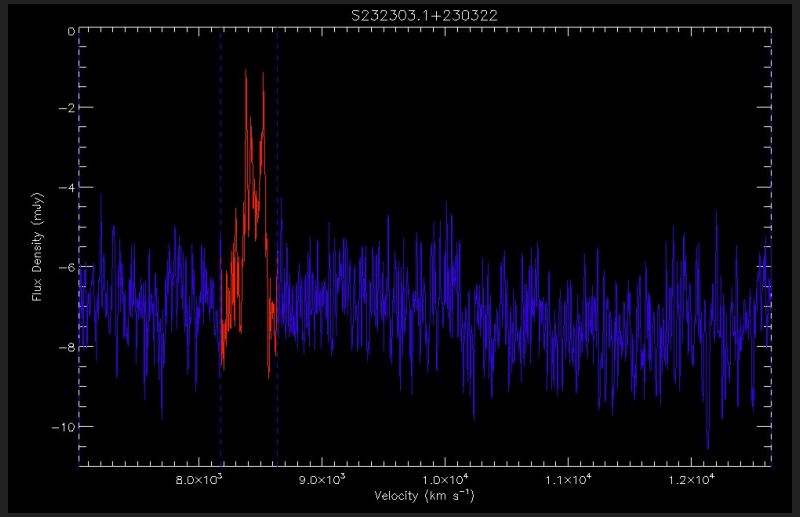
This would be considered a optimal detection. The detection has a distinct double peak profile with a fairly large W50. After identifying a detection, use command “lbwbaseline, lbwsrc” to baseline the spectra

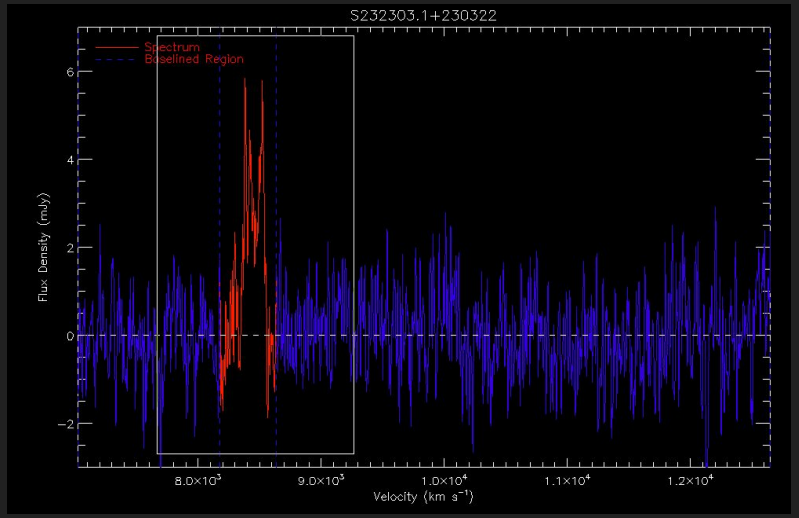

S232303.1+230322
Flux Density (mJy)
0
−2
−4
−6
−8
−10
8.0×10^3
9.0×10^3
1.0×10^4
1.1×10^4
1.2×10^4
Velocity (km s^−1)

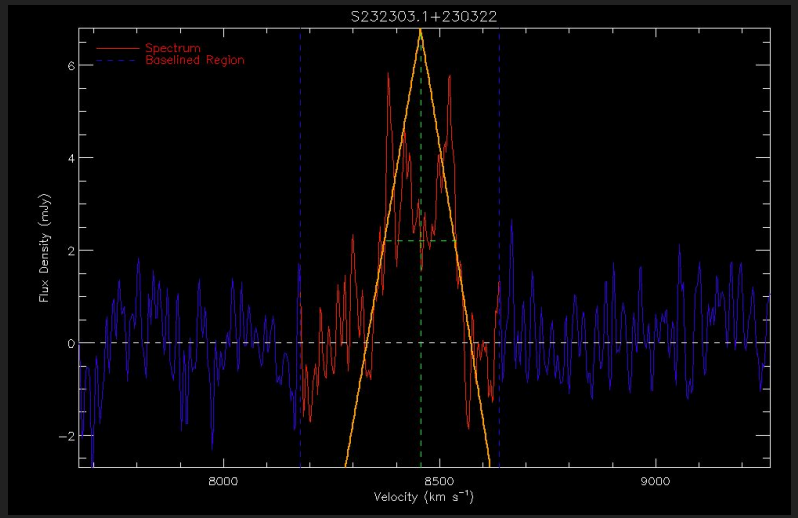

S232303.1+230322
Spectrum
Baselined Region
Fitted Baseline
Flux Density (mJy)
0
−2
−4
−6
−8
−10
8.0×10^3
9.0×10^3
1.0×10^4
1.1×10^4
1.2×10^4
Velocity (km s^−1)



Detection after baseline. Now you will use command “lbwmeasure, lbwsrc” to continue to measure the detected source with a double horn fitting.

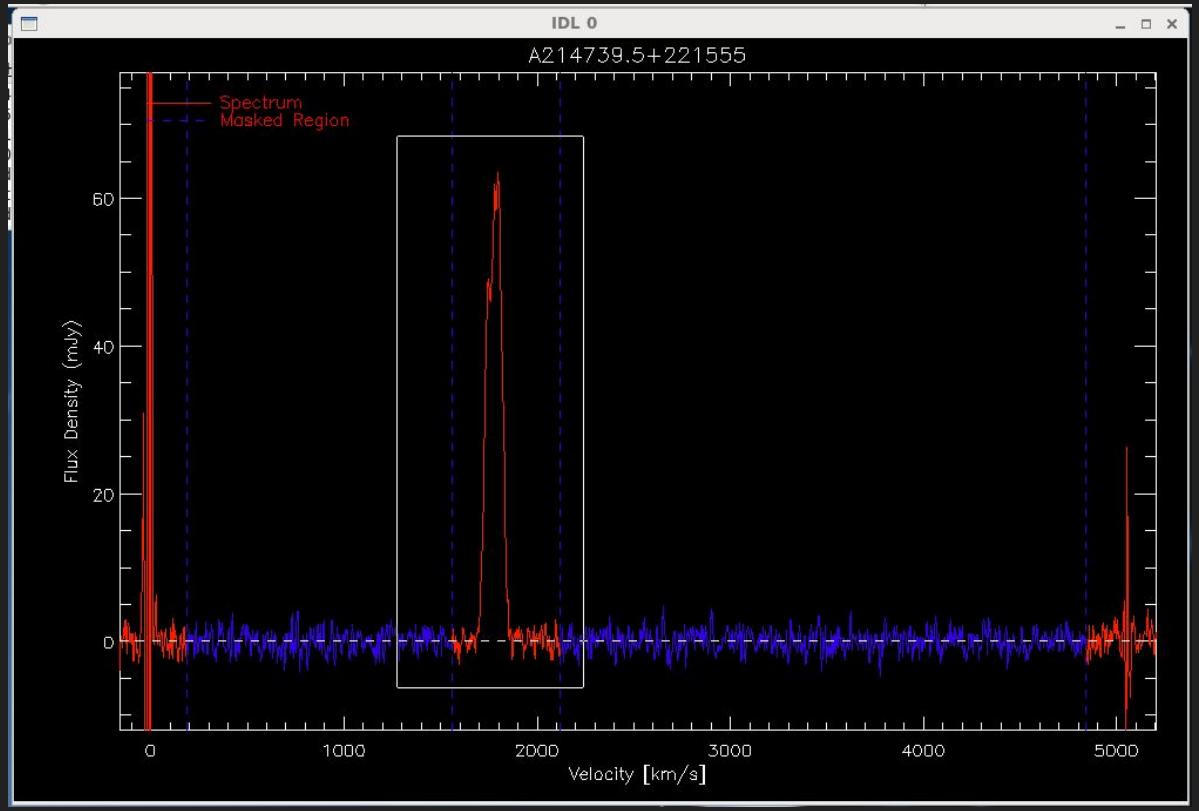






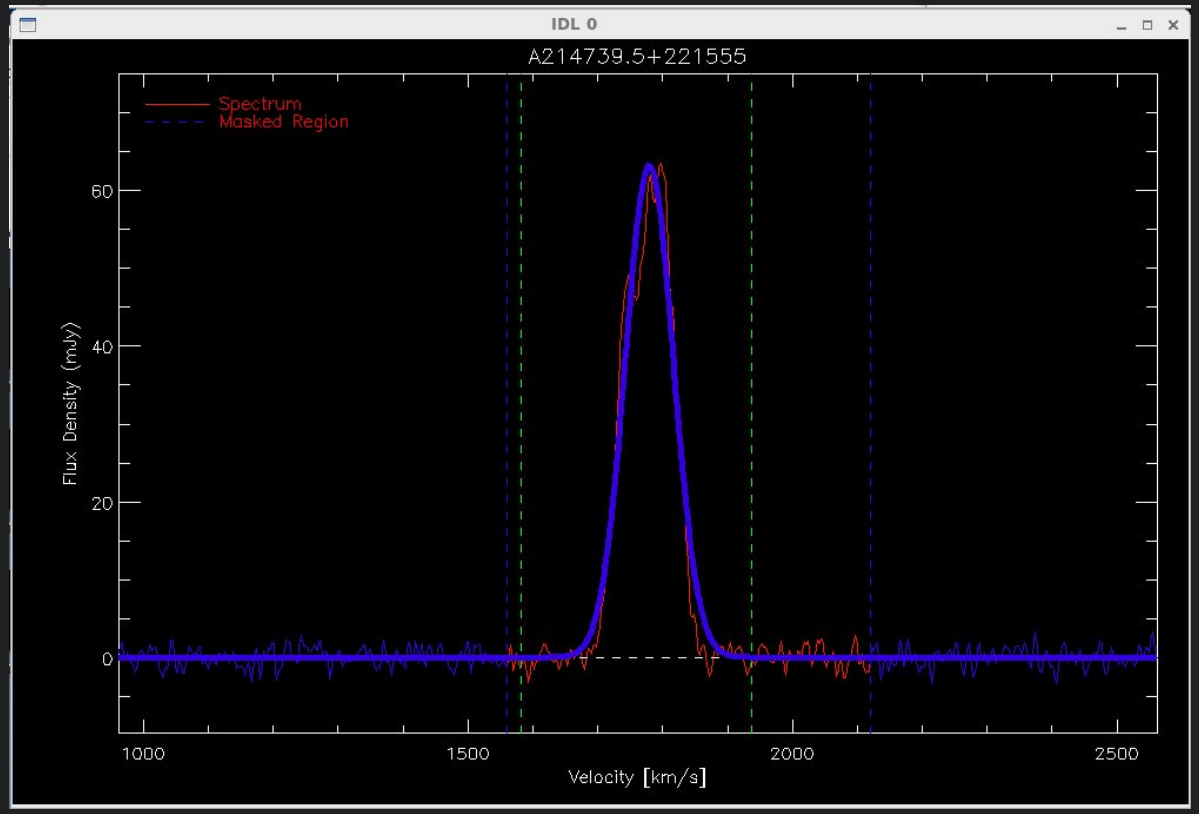
After fitting, IDL will give a variety of measurements of the detected source. Write all these measurements down on the spreadsheet.

Gaussian Fitting



This is considered a detected source that need to be measured with a gaussian fitting. After baselining, use command “lbwmeasure, lbwsrc,/gaussian” to continue with a gaussian fitting.

Gaussian Fitting



For gaussian fitting, you will select both sides of the peak and get a similar peak that the detected source has. Once fitted, IDL will give you measurements of the source. Write these measurements down on your spreadsheet.

Saving data reduced

After completing a data reduction, you will save the files that you have reduced into a your personal directory.

Save the LBW source information in a text file with the command below

IDL> lbwtoascii, lbwsrc, filename=lbwsrc.LBWsrcname + '_b'+strn(board)+'.txt'

Save a .sav file if you would like the option to come back and view the reduce data again

IDL> save, lbwsrc, filename=lbwsrc.LBWsrcname + '_b'+strn(board)+'.sav'

Other useful IDL commands

- ‘lbwsmooth’ : IDL> lbwsmooth, lbwsrc, ‘b5’ (used after baselining)
- ‘lbwplot’ : IDL> lbwplot, lbwsrc, xrange=xrange yrange=yrange
- ‘lbwrecallplot’ : IDL> lbwrecallplot, ‘.sav’
- ‘lbwquicklook’ : IDL> lbwquicklook, file='/share/wappdata.now/wapp.20161011.a3064.0001.fits'
- IDL> lbwquicklook, file='/share/wappdata.now/wapp.20161011.a3064.0001.fits',/vel,board=3,xrange=[900,11000
- ‘lbwcoadd’

lbwcoadd

```
IDL> wappfile='/share/wappdata.now/wapp.2016MMDD.a3064.0008.fits'
IDL> board = 1
IDL> lbwfromwapps,wappfile,board,struct1
IDL>
IDL> wappfile='/share/wappdata.now/wapp.2016MMDD.a3064.****.fits'
IDL> board = 1
IDL> lbwfromwapps,wappfile,board,struct2
IDL>
IDL> wappfile='/share/wappdata.now/wapp.2016MMDD.a3064.****.fits'
IDL> board = 1
IDL> lbwfromwapps,wappfile,board,struct3
```

```
IDL> lbwbaseline, struct1
IDL> lbwbaseline, struct2
IDL> lbwbaseline, struct3

IDL> input=[struct1,struct2,struct3]

IDL> lbwcoadd, input, lbwsrc

IDL> lbwmeasure, lbwsrc
```

AGCnr	srcname	RADecpoint	numspec	wappname1	wappname2	#pr	dih	quad	cont	ord	Xamo	rms	fit	W50	Werr	Vaya	Flux	SN	Wqual	Comment
323015	3220958.4+231534	220958.4+231534	1	"wapp.20151024.a2982.0007" " "		1	n	1	28	3	n	1.11018								
323015	3220958.4+231534	220958.4+231534	1	"wapp.20151024.a2982.0007" " "		1	n	2	27	1	n	1.25264								
323015	3220958.4+231534	220958.4+231534	1	"wapp.20151024.a2982.0007" " "		1	n	3	26	3	n	1.12832								
323015	3220958.4+231534	220958.4+231534	1	"wapp.20151024.a2982.0007" " "		1	n	4	30	3	n	1.54411								
322503	3221341.7+235842	221341.7+235842	1	"wapp.20151016.a2982.0000" " "		1	d	2	-1	3	85	1.1237	two peak	129.13	7.12	6818.5	0.4076	7.25	Y	high noise, boxcar smoothing 85 to reduce noise.
323001	3221542.9+230538	221542.3+230538	2	"wapp.20151125.a2982.0000"	"wapp.20151118.a2982.0000"	1	n	1	0	3	n	1.0328								
323001	3221542.9+230538	221542.3+230538	2	"wapp.20151125.a2982.0000"	"wapp.20151118.a2982.0000"	1	n	1	9	0	n	0.954								RMS after coadd: 0.8433
323001	3221542.9+230538	221542.3+230538	2	"wapp.20151125.a2982.0000"	"wapp.20151118.a2982.0000"	1	n	2	2	3	n	1.0902								
323001	3221542.9+230538	221542.3+230538	2	"wapp.20151125.a2982.0000"	"wapp.20151118.a2982.0000"	1	n	2	9	3	n	1.0457								RMS after coadd: 0.864274
323001	3221542.9+230538	221542.3+230538	2	"wapp.20151125.a2982.0000"	"wapp.20151118.a2982.0000"	1	n	3	2	3	n	1.0096								
323001	3221542.9+230538	221542.3+230538	2	"wapp.20151125.a2982.0000"	"wapp.20151118.a2982.0000"	1	n	3	8	3	n	0.95								RMS after coadd: 0.841
321944	3221559.8+235445	221559.8+235445	1	"wapp.20161024.a3064.0008" " "		1	d	2	-8	0	n	1.02772	two peak	109.33	4.16	6623.22	0.5662	13.29	Y	source was well above noise level, lots of noise bottom of source.
323020	3221620.1+235308	221620.1+235308	1	"wapp.20151118.a2982.0001" " "		1	n	1	-2	2	n	0.925956								
323020	3221620.1+235308	221620.1+235308	1	"wapp.20151118.a2982.0001" " "		1	n	2	-2	2	n	1.0358								
323020	3221620.1+235308	221620.1+235308	1	"wapp.20151118.a2982.0001" " "		1	n	3	-4	4	n	0.97031								
323020	3221620.1+235308	221620.1+235308	1	"wapp.20151118.a2982.0001" " "		1	n	4	-3	4	n	1.10271								
323025	3221846.8+234536	221846.8+234536	1	"wapp.20151106.a2982.0000" " "		1	d	3	-12	3	85	1.02593	two peak	150.36	22.712	11400.2	0.391	5.795	N	lots of noise near the source, left peak isnt well defined and is hidden in noise.
321946	3222006.7+231242	222006.7+231242	1	"wapp.20161111.a3064.0003" " "		1	n	1	-5	0	n	1.0438								no detections
321946	3222006.7+231242	222006.7+231242	1	"wapp.20161111.a3064.0003" " "		1	n	2	-6	1	n	1.11211								no detections, spike on off.
321946	3222006.7+231242	222006.7+231242	1	"wapp.20161111.a3064.0003" " "		1	n	3	-6	3	n	1.12184								no detections
321946	3222006.7+231242	222006.7+231242	1	"wapp.20161111.a3064.0003" " "		1	n	4	-6	0	n	1.11511								no detections
323026	3222104.5+231754	222104.5+231754	1	"wapp.20151115.a2982.0000" " "		1	n	1	-3	2	n	0.963236								no detections
323026	3222104.5+231754	222104.5+231754	1	"wapp.20151115.a2982.0000" " "		1	n	2	-3	1	n	1.06061								no detections
323026	3222104.5+231754	222104.5+231754	1	"wapp.20151115.a2982.0000" " "		1	n	3	-4	4	n	1.0116								no detections
323026	3222104.5+231754	222104.5+231754	1	"wapp.20151115.a2982.0000" " "		1	n	4	0	4	n	1.1271								no detections
323028	3222325.0+231137	222325.0+231137	1	"wapp.20151106.a2982.0003" " "		1	n	1	5	3	n	0.9728								no detections
323028	3222325.0+231137	222325.0+231137	1	"wapp.20151106.a2982.0003" " "		1	n	2	5	5	n	0.9788								no detections
323028	3222325.0+231137	222325.0+231137	1	"wapp.20151106.a2982.0003" " "		1	n	3	4	4	n	0.9951								no detections
323028	3222325.0+231137	222325.0+231137	1	"wapp.20151106.a2982.0003" " "		1	n	4	4	3	n	1.0641								no detections
322515	3222551.4+230620	222551.4+230620	2	"wapp.20151127.a2982.0000"	"wapp.20151119.a2982.0001"	2	d	3	-2	3	85	2.0813	two peak	167.62	16.713	11757.2	0.2922	4.128	U	rms for 1st: 1.08060, rms for 2nd: 1.77584, lots of RFI.
322063	3222558.9+230559	222558.9+230559	1	"wapp.20161121.a3064.0002" " "		1	d	3	3	3	85	1.0763	two peak	134.91	4.91	10060.93	0.5072	9.217	U	source had weak double peak, fitting was decent
323036	3223035.2+234630	223035.2+234630	1	"wapp.20151106.a2982.0004" " "		1	n	1	-3	1	n	0.958466								RFI, no detections
323036	3223035.2+234630	223035.2+234630	1	"wapp.20151106.a2982.0004" " "		1	n	2	-3	1	n	1.01047								RFI, no detections
323036	3223035.2+234630	223035.2+234630	1	"wapp.20151106.a2982.0004" " "		1	n	3	-3	1	n	0.934012								RFI, no detections
323036	3223035.2+234630	223035.2+234630	1	"wapp.20151106.a2982.0004" " "		1	n	4	-3	4	n	1.00553								RFI, no detections
322534	3223333.6+231255	223333.6+231255	1	"wapp.20151024.a2982.0007" " "		1	n	1	26	0	n	1.12023								
322534	3223333.6+231255	223333.6+231255	1	"wapp.20151024.a2982.0007" " "		1	n	2	25	1	n	1.25119								
322534	3223333.6+231255	223333.6+231255	1	"wapp.20151024.a2982.0007" " "		1	n	3	26	3	n	1.12905								
322534	3223333.6+231255	223333.6+231255	1	"wapp.20151024.a2982.0007" " "		1	n	4	26	5	n	1.38626								
323101	3223558.0+234824	223558.0+234824	1	"wapp.20151128.a2982.0000" " "		1	n	1	-7	1	n	1.00281								lots of RFI, no detections
323101	3223558.0+234824	223558.0+234824	1	"wapp.20151128.a2982.0000" " "		1	n	2	-9	1	n	1.15143								lots of RFI, no detections
323101	3223558.0+234824	223558.0+234824	1	"wapp.20151128.a2982.0000" " "		1	n	3	-10	3	n	1.15886								lots of RFI, no detections
323101	3223558.0+234824	223558.0+234824	1	"wapp.20151128.a2982.0000" " "		1	n	4	-10	3	n	1.44463								lots of RFI, no detections
322539	3223627.4+235400	223627.4+235400	1	"wapp.20151127.a2982.0001" " "		1	n	1	-4	3	n	1.0874								
322539	3223627.4+235400	223627.4+235400	1	"wapp.20151127.a2982.0001" " "		1	n	2	-5	3	n	1.20069								
322539	3223627.4+235400	223627.4+235400	1	"wapp.20151127.a2982.0001" " "		1	n	3	-5	4	n	1.04382								
322539	3223627.4+235400	223627.4+235400	1	"wapp.20151127.a2982.0001" " "		1	n	4	-6	0	n	1.08244								
322990	3224458.8+232512	224458.8+232512	2	"wapp.20151126.a2982.0002"	"wapp.20151120.a2982.0003"	1	n	1	-10	1	n	0.9402								
322990	3224458.8+232512	224458.8+232512	2	"wapp.20151126.a2982.0002"	"wapp.20151120.a2982.0003"	1	n	1	-6	2	n	0.8882								RMS after coadd: 0.599172
322990	3224458.8+232512	224458.8+232512	2	"wapp.20151126.a2982.0002"	"wapp.20151120.a2982.0003"	1	n	2	-12	4	n	1.0134								
322990	3224458.8+232512	224458.8+232512	2	"wapp.20151126.a2982.0002"	"wapp.20151120.a2982.0003"	1	n	2	-8	3	n	1.0225								RMS after coadd: 0.647071
322990	3224458.8+232512	224458.8+232512	2	"wapp.20151126.a2982.0002"	"wapp.20151120.a2982.0003"	1	n	3	-12	2	n	1.0753								
322990	3224458.8+232512	224458.8+232512	2	"wapp.20151126.a2982.0002"	"wapp.20151120.a2982.0003"	1	n	3	-8	3	n	1.0459								RMS after coadd: 0.664436
322990	3224458.8+232512	224458.8+232512	2	"wapp.20151126.a2982.0002"	"wapp.20151120.a2982.0003"	1	n	4	-12	4	n	1.1525								
322990	3224458.8+232512	224458.8+232512	2	"wapp.20151126.a2982.0002"	"wapp.20151120.a2982.0003"	1	n	4	-8	1	n	1.1491								RMS after coadd: 0.664436