# OH Masers

Mayra E. Lebrón Santos(Arecibo Observatory)

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When observing with a single dish telescope in a position switching mode, the theoretical rms noise in the spectra is given from:

$$\Delta T(K) = 2\frac{T_{sys}}{\sqrt{B \;\; t_{int}}}$$

where $T_{sys}$ is the system temperature (in Kelvin), B is the bandwidth per frequency channel (in Hz) and $t_{int}$ is the total integration time per circle(in sec). Therefore, for a given receiver, the rms noise, the bandwidth per channel and the integration time are closely related.

## 1 Data reduction

Documentation:

- *Notes Relevant to SpectralLine Calibration* by Chris Salter ($http://www.naic.edu/\sim astro/calibration/notes - cjs.ps$)
- Phil Perillat web page on correlator IDL routines ($http://www.naic.edu/\sim phil/cordoc.html$)
- *Cookbook for data reduction of Arecibo data using IDL* by Ellen Howell ($http://www.naic.edu/\sim data/data_formats/idl/idlcook.ps$)

### 1.1 starting idl

To start IDL, type: **idl**

IDL> @corinit ;that will define the necessary paths.

IDL> openr,lun,'/home/scratch/sumschool/proj1a/corfile.12aug03.x113.1',/get_lun (that will open the data file and put in the local unit lun)

IDL> corlist,lun ; that will list all the scan inside of lun

IDL> scan=3...... ; select a particular scan

IDL> istat=corposonoff(lun,b,sclcal=1,scan=scan) ; obtaining antenna temperature.

IDL> b_cor = corgain(b) ;gain correction (scale to Jy)

IDL> baveg=coravg(b_cor,/pol) ; average the 2 pol of a scan

Accumulating various scans.

IDL> coraccum,baveg,total,/new

IDL> corplot,total

Baseline correction. The subroutine *corbl* fits a polynomial of n order to the data. The mask is chosen interactively for each board. With the option /sub the subtraction of the data-fit is returned in blfit.

IDL> bbl=corbl(b_cor,blfit,maskused,/sub)

IDL> corplot,blfit

Creating a postscript file,

IDL> set_plot,'ps'

IDL> device, set_font ="Times−Roman",filename='file.ps',ysize=12

IDL> corplot,total

IDL> device,/close

IDL> set_plot,'x'

## 1.2 Scaling the data from correlator units to Kelvin

Relative calibration is done using the noise diode (known as *cal* of a known temperature. *CAL* observations were performed in a position switching mode, whereby a spectrum is taken of a blank piece of sky while the noise diode was switched ON, and then taken again with the noise diode being switched OFF. The ON and OFF measurement were taken at the same zenith angle and azimuth. A simple analytical expression for the ON and OFF-source receiver output can be given by:

$$CAL_{ON} = G(\nu)(T_{sys} + T_{cal}),$$
$$CAL_{OFF} = G(\nu)T_{sys},$$

where $G(\nu)$ is the transfer function of the whole receiver, that converts the antenna temperature into digital data.

Then the $T_{sys}$ will be given by

$$T_{sys}(K) = T_{cal} \quad \frac{CAL_{OFF}}{CAL_{ON} - CAL_{OFF}}.$$

The antenna temperature ($T_{source}$) will be then,

$$T_{source}(K) = T_{cal} \times \frac{CAL_{OFF}}{CAL_{ON} - CAL_{OFF}} \times \frac{ON - OFF}{OFF}$$

The subroutine *corposonoff* process a position switching on/off pair, returning a single spectra for each polarization in each board. It performs an $ON - OFF/OFF \times T_{sys}$, returning the data in Kelvin.

This section was taken from the First Single Dish Summer School, HVC hand-on project notes written by Snezana Stanimirović.