

ezRA - Easy Radio Astronomy - ezCon

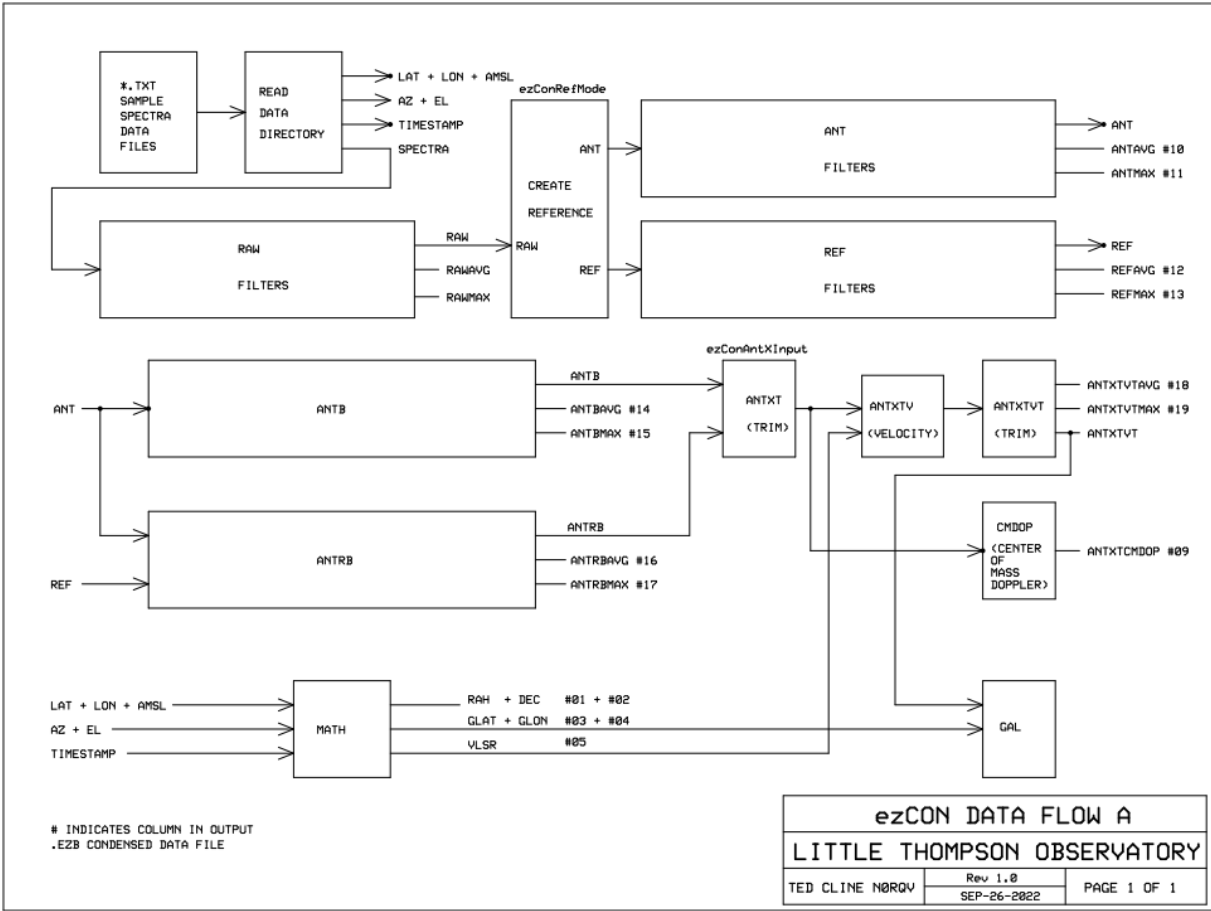
- Sep-27-2022

The ezRA Easy Radio Astronomy set of programs are free PC tools to help explore Radio Astronomy. The programs run on the Python3 programming language, on Windows and Linux.

ezCon Data Condenser

ezCon - CONDense one or more frequency spectrum data .txt files into
one .ezb text data file, and perhaps one GALaxy *Gal.npz data file.

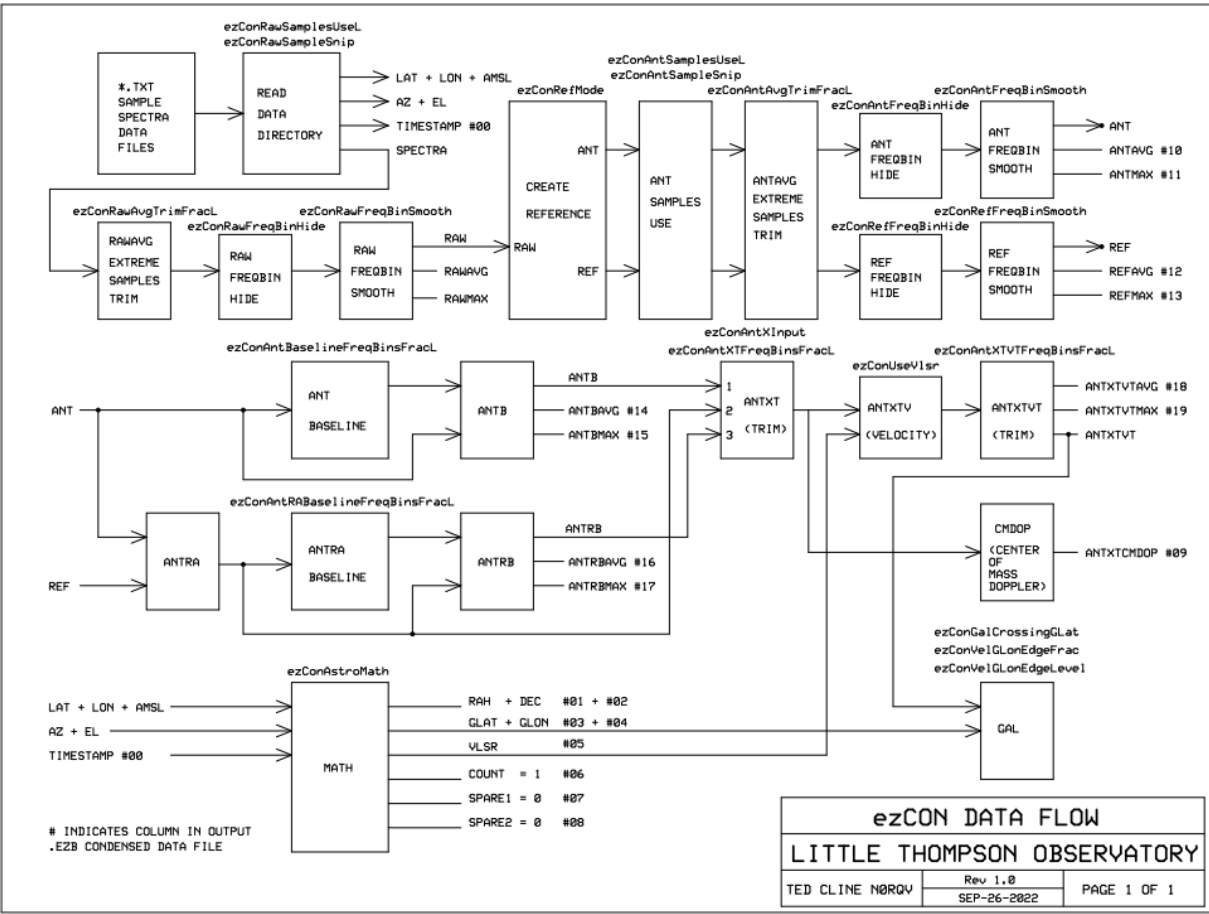
Here is simplified diagram of the data flow inside the ezCon program.



Starting at the top left, ezCon reads .txt data files, filters the Raw data samples, and separates them into Antenna (Ant) samples and Reference (Ref) samples.

Continuing at center left, ezCon uses those Ant and Ref samples to create the AntB and AntrB signals. It then selects AntB (default) or AntrB, and creates AntXT, AntXTV, and AntXTVT signals. All to better reveal Galactic hydrogen emissions and the information it contains. Default values for the many options provide guidance.

Here is a more detailed diagram of the data flow inside the ezCon program.



Creator of the 20-column *.ezb Condensed Data File (with # indicating data file column).

Many software sections are controlled by command line arguments, shown above the boxes.

Frequency spectrum information leaves ezCon only by saved plot files, the AntXTCMDop column, and the *Gal.npz file.

.ezb Condensed Data File Format

20 data columns, human-readable text, and excel-readable to study and plot graphs.

An .ezb file's text will start something like this:

```
# from ezCon220924a.py
# ..\ezRA\ezCon.py  data\N0RQV200503_00.txt

lat 40.4 long -105.1 amsl 1584.0 name N0RQV8
freqMin 1419.2 freqMax 1421.6 freqBinQty 256
ezbMenu: TimeUtcMjd  RaH  DecDeg  GLatDeg  GLonDeg  VLSR  Count
Spare1  Spare2  AntXTCMDop      AntAvg  AntMax      RefAvg  RefMax
AntBAvg  AntBMax      AntRBAvg  AntRBMax      AntXTVTAvg  AntXTVTMax
#          0          1  2          3          4          5          6
7          8          9          10         11         12         13
14         15         16         17         18         19
58972.00006 5.230 -3.571 -23.294 -155.349 3.331e+01 1 0 0 0
4.90132e+02 5.07724e+02 4.90132e+02 5.07724e+02 1.00139e+00
1.03733e+00 1.00000e+00 1.00000e+00 1.00161e+00 1.03671e+00
...
```

There are many lines of 20 ragged columns of numbers, with a few header lines.

The .ezb file's first line is blank, with no characters.

The second line gives the long revision name of the ezCon program that created it. As a comment, it is largely ignored by the ezRA programs.

The third line is the command that created this file. Eventually, we will adjust ezCon program parameters, and this line will record what settings were used. As a comment, it is largely ignored by the ezRA programs.

The fourth line is blank, with no characters.

The fifth line records the data's earth location info, and the antenna Name (for plot titles). This information may be used later to plot the data's azimuth and elevation.

The sixth line records the data's Minimum Frequency (in MHz) and Maximum Frequency. No immediate need for this frequency information, but helpful to describe the data set.

Next is the ezbMenu line, with the titles of the 20 data columns to follow.
Next is a comment line, with the 20 column numbers

Then comes one line for each sample's condensed data, in 20 columns.

The ezbMenu of 20 .ezb file columns are 2 groups of related values.
The 9 “Coordinate” columns, and the 11 “Signal” columns.

9 “Coordinate” columns:

00	TimeUtcMjd	Modified Julian Day (MJD) time is the fractional number of days since the start of November 17 1858, in UTC (Coordinated Universal Time)
01	RaH	Right Ascension (hours)
02	DecDeg	Declination (degrees)
03	GLatDeg	Galactic Latitude (degrees)
04	GLonDeg	Galactic Longitude (degrees)
05	VLSR	Velocity from the Local Standard of Rest (km/sec)
06	Count	All Count values are currently 1
07	Spare1	All Spare1 values are currently 0
08	Spare2	All Spare2 values are currently 0

11 “Signal” columns (AntXTCMDop, and 5 pairs of Averages and Maxima):

09	AntXTCMDop	AntXT spectra Center of Mass Doppler (MHz)
10	AntAvg	Ant spectra Average values
11	AntMax	Ant spectra Maximum values
12	RefAvg	Ref spectra Average values
13	RefMax	Ref spectra Maximum values
14	AntBAvg	AntB spectra Average values
15	AntBMax	AntB spectra Maximum values
16	AntRBAvg	AntRB spectra Average values
17	AntRBMax	AntRB spectra Maximum values
18	AntXTVTAvg	AntXTVT spectra Average values
19	AntXTVTMax	AntXTVT spectra Maximum values
