

Haystack Observatory - - Small Radio Telescope

Measure Antenna Beamwidth using the Sun as a Signal Source

Introduction:

The beamwidth of a radio telescope is the solid-angle measure of the half-power point of the main lobe of the antenna pattern. The half-power beamwidth (HPBW) can be measured by moving the telescope in a continuous scan across a very bright radio source. Except for the possibility of Cygnus-X or certain geo-synchronous satellites, the only source available to the SRT is the Sun.

Measurement of the beam pattern can help the user discover problems with optical alignment or aid in the determination of the antenna focus.

Procedure:

The SRT has azimuth and elevation travel limits that will constrain the user conducting the Sun scan to times close to local noon. This will allow maximum offset from the sun in order to establish a stable baseline for the scans and an off-source calibration position that will not be overpowered by the sun's brightness temperature. For the off-source calibration, an area **at least two beamwidths** (in azimuth, positive or negative) away from the sun is desirable.

A sample command file for the Horizontal (Azimuth) then Vertical (Elevation) scans might look like this:

```
: record filename           /Start recording, output filename is optional
: azel 130 45                 /calibration position
: 1415 5 0.0                 /scan frequency, 5 bins (samples), no frequency step
: calibrate                  /calibration
: Sun                        /Source command
* Azimuth Scan               /Comment
: offset -30 0               /start offset commands for scan -30 to +30 degrees
: offset -29 0
: offset -28 0
: offset -27 0
: offset -26 0
: offset -25 0               /through to offset 30 0
:
* Elevation Scan            /Comment
: offset 0 30                /Start elevation scan (if sun El is <60 degrees!)
: offset 0 29
: offset 0 28
: offset 0 27
: offset 0 26
: offset 0 25               /through to 0 -30
: roff                       /End recording
```

SRT Commands:

From an MSDos prompt change your directory to the sub-directory where your compiled srt java software is resident. Type the following command to start the SRT software:

```
C:\srtjava> java srt 0
```

When the SRT front panel appears, move the mouse pointer to the upper right of the control console and click the button labelled:

Rcmdfl

Move the mouse pointer down to the command line input box and type the SRT command filename you wish to open:

Filename.cmd /*example = beamsize.cmd (the suffix .cmd is required)

The software will read the input command file similar to the above example in sequence and output and ASCII text file that can be processed by a spread sheet such as MS-Excel or a hand written program to process the data in your particular form.

Output:

Output data will default to a day/time stamp ASCII text file with the filename:

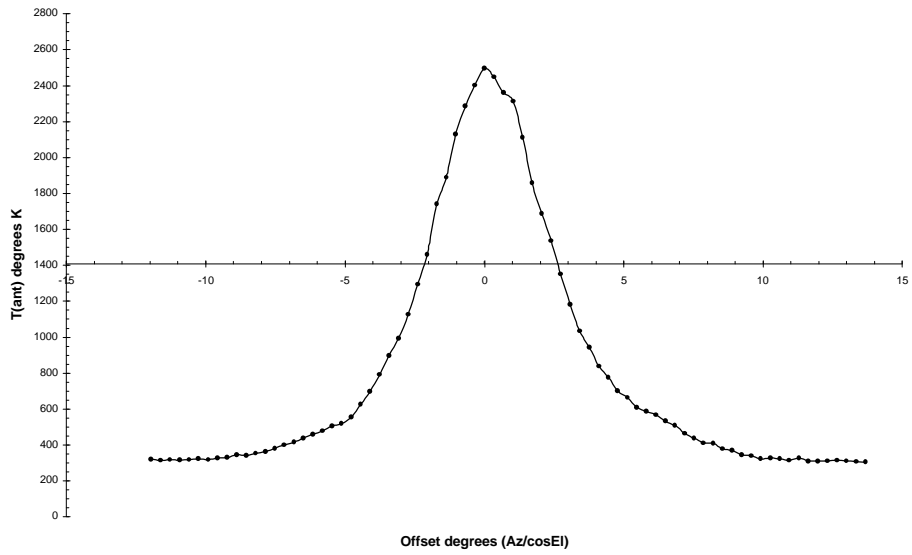
yydddhh.RAD

Where, **yy** is the year, **ddd** is the day number (UT) and the **hh** is the UT hour at the opening of the output file

The resulting scan plots might look like the plots seen on the next page. These plots are the output from MS-Excel.

The azimuth-plot horizontal scale reflects the correction of azimuth degrees above the horizon by the cosine of the elevation angle. The horizontal scale on both plots has been drawn through the half-power points.

Azimuth Sun-scan



Elevation Sun-scan

