

## 10. Suncal Utility

The sun can serve as an external radiation source for calibration of a radar system which is simple and requires no external hardware to the radar system. The sun's precise position can be calculated from any point on Earth at any given time providing a convenient check for the antenna pointing accuracy and beam width measurements. The sun's power can also be a useful technique for monitoring the calibration of the receive chain of the radar when used in conjunction with independent measurements of solar flux density.

The **suncal** utility is a stand-alone program that scans the sun's position and outputs calibration data. The utility is supplied with both the RDA and IRIS releases and will work with any supported signal processor and any antenna controller accessible via the antenna library. The **suncal** utility can be run interactively from a command line and requires no graphical interface. It can also be inserted into the Task Scheduler as an Exec Task and run on a routine basis.

The **suncal** utility performs sector scans of the sky centered on the sun's calculated position and outputs a BEAM product. The BEAM product will contain SNR data with no thresholding and can be viewed on an IRIS system, but is not automatically inserted into an IRIS product directory. The BEAM product is then processed to produce a final calibration file.

The calibration file will contain:

- Time the calibration was performed
- Location of the sun during the calibration
- Noise level in dBm (not available for the RVP6)
- Peak power of the sun
- Average power of the sun
- Mean Antenna Azimuth offset error
- Mean Antenna Elevation offset error
- 3 dB 1-way Azimuth beam width
- 3 dB 1-way Elevation beam width

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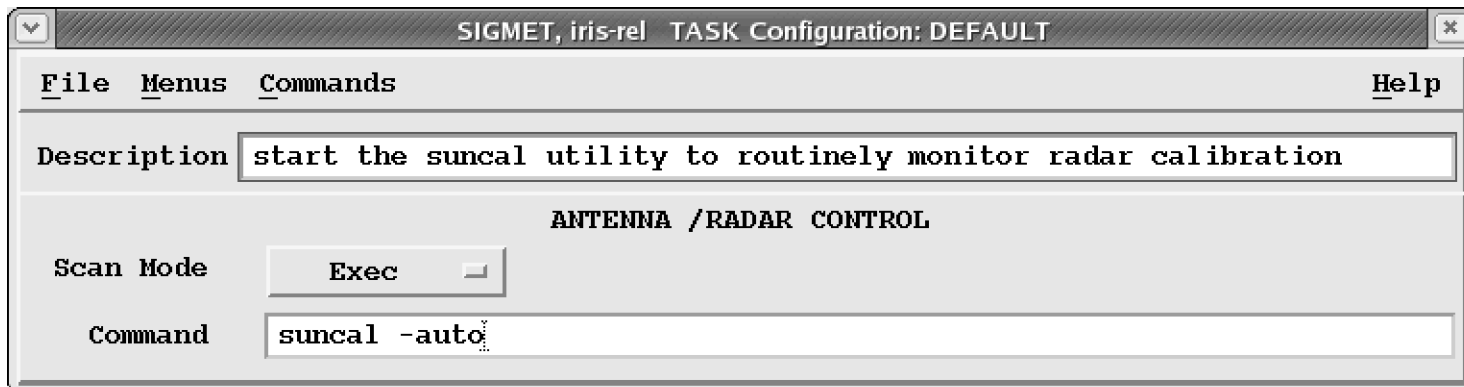
## 10.1 Invoking Suncal and Options

### Command

**suncal**

**Suncal** was designed without a graphical utility so it can be run as an IRIS Exec Task. When running automatically from the IRIS task scheduler the **suncal** utility will produce an IRIS signal if either the measured sun peak power is below a specified threshold, the offset errors are larger than desired, or the sun is not high enough above the horizon to run. This is useful for running **suncal** in the background of normal operations and still being able to monitor the calibration of the receive chain. Note: the power calibration will not be valid on the RVP6. The **-auto** option is normally given when running as an Exec Task to preclude output to a terminal window.

### Suncal Exec Task



**Suncal** may also be run interactively from the command line. If run interactively, the current status is reported on the terminal as well as reporting the calibration results. There is also an option to process an input BEAM product that may have been created at some earlier date which can be useful for remote testing. For example, a user can run the suncal utility and the send Sigmet the resulting BEAM product which we can then process.

Table 10–1 lists the options to the suncal utility that you can enter.

**Table 10–1: Suncal Command Line Options**

<b>-auto</b>	Do not log progress on the terminal
<b>-beam:&lt;path&gt;</b>	Process an existing BEAM product
<b>-help</b>	Print this list
<b>-resave</b>	Create a default suncal.conf file with comments and all fields

## 10.2 Calibration Calculations

Solar scans are capable of providing the user with antenna pointing calibration, antenna beam width measurements, and receive chain calibration. Variation in the solar flux of the sun has little effect on the antenna pointing and beamwidth measurements. Changes in the solar flux density will impact the power measured by the receiver. However independent measurements of the solar flux density can be used to determine the antenna gain of the radar system. This section will explain calculations used by the **suncal** utility to measure these quantities.

The **suncal** utility accesses the antenna library to determine the location of the sun in the sky. The current time and date is taken from the local computer to compute the sun's position. A "SUNCAL" PPI sector scan is created and started centered at the sun's initial position minus half of the elevation span given in the suncal.conf file. To account for the sun's movement during the scan some corrections need to be made so the output is similar to a non-moving radiation source. To do this the sun's position will be recalculated at the completion of each sweep and then corrections will be made to the final antenna angles for the sun's new position. For example, if the sun moved towards the horizon by 0.1 degree during the "SUNCAL" task and there were five sweeps the elevation angle of each sweep would be numerically increased by approximately 0.02 degrees. The same angle corrections would occur in the azimuth direction, if needed. The BEAM product is made after the angle corrections.

To determine any antenna pointing errors, the measured location of the sun is calculated by first thresholding the data on a user configured power threshold. A power weighted average position and standard deviation is then computed from the passed pixels. The weighted average position is then compared to the sun's calculated position at the start of the scan and offsets are given in both azimuth and elevation. The standard deviation is used to determine if there is a missing sun.

Antenna beam width calculations go here...

## 10.3 Suncal Configuration File

Configuration of the **suncal** utility is done by the suncal.conf file stored in the \${IRIS\_CONFIG} directory. Within the suncal.conf file users can input the details of the scanning strategy, data output directories, and whether to create a log file. A sun simulator is built in to the utility to help design reasonable sector scans.

Running the **suncal** utility with the `--resave` options will create a default suncal.conf file. The user can then change parameters within the suncal.conf file to suit their needs. Below is an example suncal.conf file.

```
$ cat /usr/sigmet/config/suncal.conf
# ***** <-- suncal.conf file here
# *
# *   Suncal Configuration File   *
# *
# *****
```