Activity: Focusing the SRT

Finding the focal length, adjusting the focal length, measuring the effects of changing the focal length of the SRT.

Once the dish and the feed supports of the SRT have been assembled the **focal point** of the dish must be determined and adjusted to maximize antenna efficiency. The focal point is the common point that all of the collected radio waves will be reflected back to. The distance from the center of the dish to this point in front of the dish is the **focal length** of the antenna. SRT antennas have changed in size, depth and location of feed supports. This in turn has changed the focal length of the collecting dish. The diameter and the depth of the dish, determine the focal point of the dish itself. The feed supports determine the placement of the receiver, which must be at the focal point of the telescope.

Step one: Determining dish measurements:

With the dish in the stow position measure the diameter of the dish and the depth of the dish. Using a length of string or thin wire determine the diameter of the dish.

1. Tie the string or wire to one edge of the dish and stretch the wire across the dish. When you have the measuring device at it's maximum possible length, you have the diameter. Anything less would be a chord of the circle. Tie the second end to the dish at its maximum length.

2. Measure the length of the string with a tape measure.

3. From the center of the string measure down to the center of the dish. This is the depth of the dish.

4. From the center of the dish measure up to the bottom of the plastic circle (phase center) on the bottom of the receiver. This is the distance of the receiver from the dish.

A) Dish Diameter: _____

B) Depth of the dish: _____

Step Two: Finding the focal length of the SRT:

The formula for finding the focal length of the dish is: f=Dsquared/16x

D= diameter of the dish (inches)
X = depth of the dish (inches)

Using your data, what is the focal length of the SRT?

C) Focal length of SRT: _____

Step Three: Current placement of the receiver & adjustment:

What did you find for the current distance receiver to center of the dish in step one?

_____

What is the focal length of the SRT that you found mathematically?

_____

What is the difference between the two measurements? (= focal length adjustment)

_____

There have been at least two different feed support systems supplied with the dishes. The most recent and easiest to adjust features the feed arms located about ¼ of the way inside of the dish. The length of the feed arms can be changed by inserting lengths of ½" ID pvc water pipe as stand offs.

Cut four pieces of pvc to the length of the focal length adjustment. Cut two other sets of stand offs, one set one half inch longer, a second set one half inch shorter than the calculated focal length adjustment. These pvc sections will serve as sleeves around the bolts. You will also need to obtain four 3/8" bolts that are about 3" long to replace the existing feed support bolts.

Procedure:

Using the AzEl command, direct the SRT to an empty point in the sky. Set the frequency of the SRT to 1415. MHz and 4 bins (1415 4). Using the "vane" or "calibrate" command (whichever is available on your SRT), calibrate the SRT without any focal length adjustments. Record in your data table: date, time, frequency, and length of stand off if any, tysys, calcon, trec, counts, and temp (k).

Aim the SRT at the sun and record in your data table: date, time, frequency, tysys, calcon, trec, counts, and temp (k).

With the SRT antenna in the 88 degrees of elevation position, loosen the nuts on the bolts of two adjoining feed arms. Remove the nuts off of the remaining two feed arms. Lift the one of the feed arms that has had the nut removed. Remove the old bolt; insert the new, longer bolt. Place the **smallest** pvc stand off over the bolt between the feed arm and the antenna. Loosely attach the nut to the bolt. Move to one of the feed arms that still has a nut on it. Follow the same procedure to replace the bolt & insert the stand off. Repeat until all four feed arms have been extended. Go around and tighten all of the nuts.

Aim the SRT at the sun and record in your data table: length of stand off, date, time, frequency, tysys, calcon, trec, counts, and temp (k).

Return the SRT antenna in the 88 degrees of elevation position; loosen the nuts on the bolts of two adjoining feed arms. Remove the nuts off of the remaining two feed arms. Lift the one of the feed arms that has had the nut removed. Remove the old bolt; insert the new, longer bolt. Place the **largest** pvc stand off over the bolt between the feed arm and the antenna. Loosely attach the nut to the bolt. Move to one of the feed arms that still has a nut on it. Follow the same procedure to replace the bolt & insert the stand off. Repeat until all four feed arms have been extended. Go around and tighten all of the nuts.

Aim the SRT at the sun and record in your data table: length of stand off, date, time, frequency, tysys, calcon, trec, counts, and temp (k).

Return the SRT antenna in the 88 degrees of elevation position; loosen the nuts on the bolts of two adjoining feed arms. Remove the nuts off of the remaining two feed arms. Lift the one of the feed arms that has had the nut removed. Remove the old bolt; insert the new, longer bolt. Place the pvc stand off that **equaled your focal length adjustment** over the bolt between the feed arm and the antenna. Loosely attach the nut to the bolt. Move to one of the feed arms that still has a nut on it. Follow the same procedure to replace the bolt & insert the stand off. Repeat until all four feed arms have been extended. Go around and tighten all of the nuts.

Aim the SRT at the sun and record in your data table: length of stand off, date, time, frequency, tysys, calcon, trec, counts, and temp (k).

Questions:

Which of the four receiver settings (no stand off, etc.) produced the highest temperature readings?

It would be expected that the highest temperature readings would be with the stand offs that were designed to correct the focal length. Was this the case? If not, why would this have happened?

What effect does a ½" change in focal length have on receiver efficiency?

Do you think time of day (morning versus noon, afternoon) would have an effect on your temperature readings?

Make a graph of temperature reading versus length of stand off.

Does the graph yield a straight line? Why or why not?

Data table: