Subject: Cylinder Horn Construction and Feed Probe Position
Memo: 22, Rev 1
From: Glen Langston, Kevin Bandura and Steve White
Date: 2018 June 29

We give step by step instructions on construction of a sensitive horn for observation of neutral hydrogen. These measurements show significant improvement in the feed gain is achieved by proper placement of the feed probe..

The process of perfecting the feed horn and probe has been slow. The first memo on this topic in the LightWork series is memo 3, dated 2015 July 28

Background

We'd made a large number of observations with a variety of feed horns including folded designs, pyramid horns and bubble wrap horns. In the end the bubble wrap horn seemed to be the easiest to build and nearly the least expensive, given its capabilities.

Steve White, of the NSF's Green Bank Observatory, was given parameters on the available 12inch long, 6 inch diameter pipe and feed probe configuration. He then ran a large number of structural electromagnetic models to find the optimum feed probe diameter, Ncen, distance to rear of the cylinder and feed probe length. The parameters are listed below. Figure 1 shows the S11 plot for these parameters.

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Ncen_r = 0.70 mm
probetoR = 73.8 mm
probe_L = 47.2 mm

Optimized arrangement with circular waveguide.
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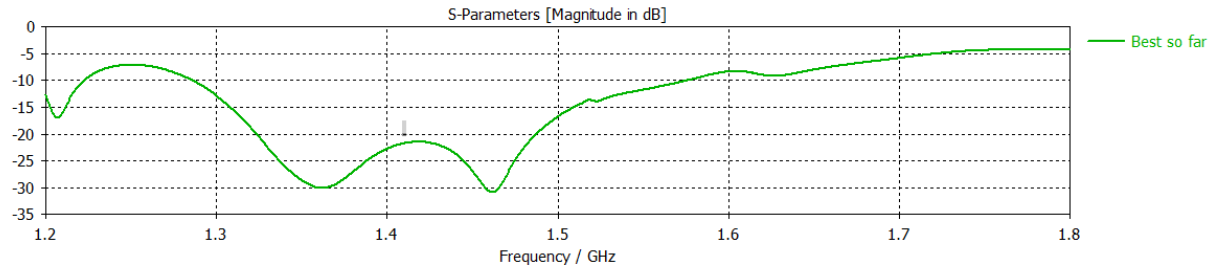

A group of educators are prototyping construction of small radio telescopes for educational use. Our group includes West Virginia University and the Green Bank Observatory (greenbankobservatory.org).

We have designed and constructed all the electronics and receiving section for this radio telescope. Our system consists of electronics attached to a 6" diameter, 1 foot long stove

pipe. We need to add collecting area to increase sensitivity. We would like to price a better quality radio wave collecting system built from 26 gauge (or so) aluminum sheeting.

The cone we wish you to fabricate will connect to the crimped end of a stove pipe. The cone will attach to a 6” diameter stove pipe with crimped end. The cone is 32 inches high and 32 inches wide at the wide end.

The cone shape of the main body has height (H) of 30inches. Large and small radii are R1 = 16inches, and R2 = 3inches. The narrow end of the cone should have a straight section, 1.75 inches high and 6 inch diameter, to match a standard crimped stove pipe. The horn should have a lip to prevent accidental cuts and add strength.

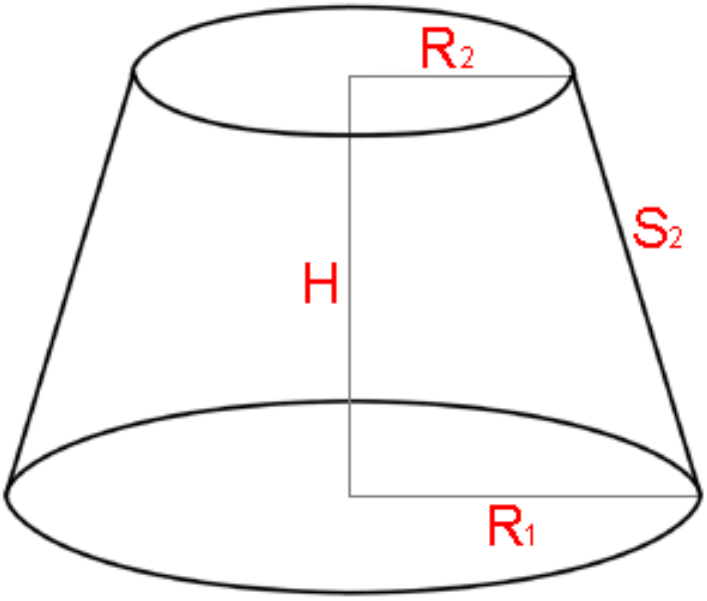

Figure 2: Simplified cone diagram, indicating the measurements of the cone needed.

Currently we instruct the students to build a cone from bubble wrap. See figures below. This bubble cone is slightly shorter, 30inches tall, and connects to a 8” stove pipe.

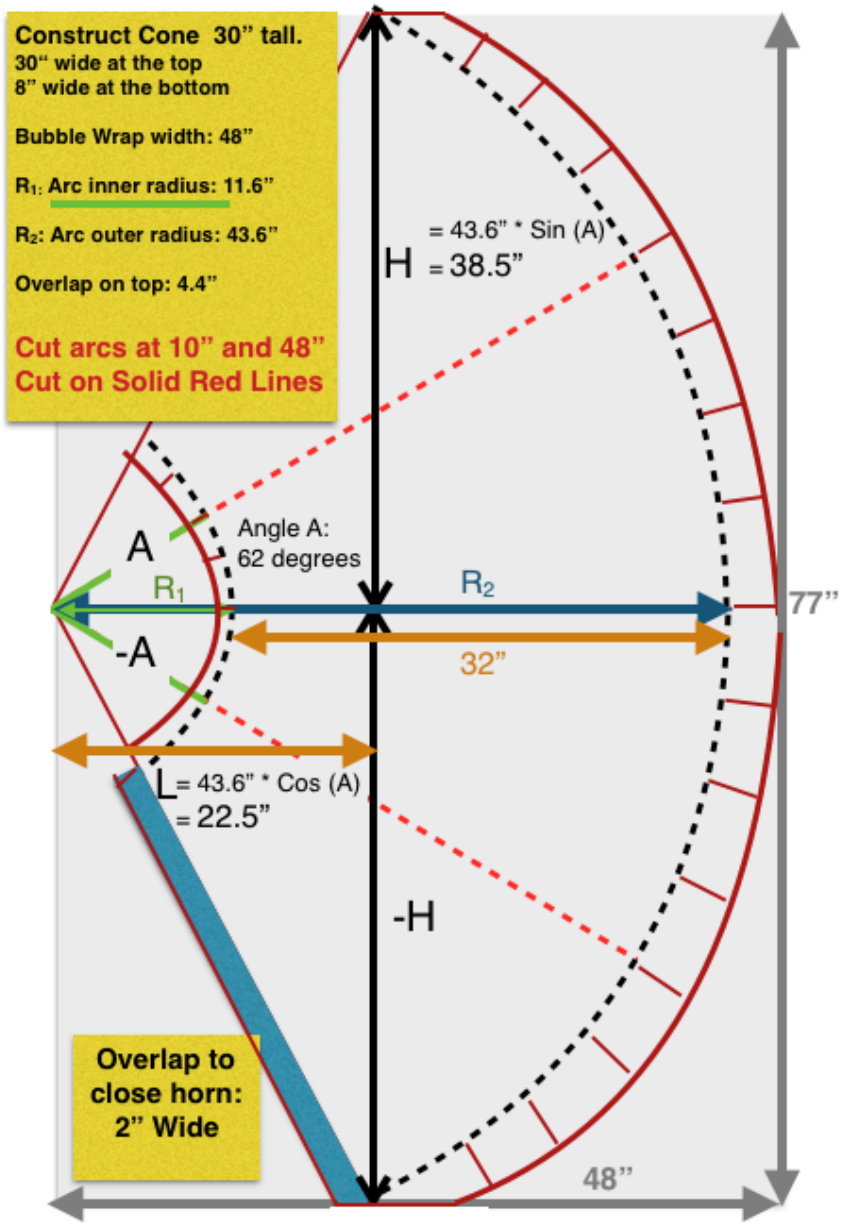

Figure 2: Our current student-constructed cone design.

Conclusions