Practical 2

Kapteyn Radio Telescope - Observations and Data Analysis

16 December 2016

Basic concepts

What you need to recall:

- Black body radiation
- Antennas
- Calibration
- Atmospheric opacity

Where to find them:

- Dipoles, Dishes and Radiometers Lectures (3-4-5)
- User Manual of Kapteyn Radio Telescope
- Book “Tool of Radioastronomy” [Wilson et al. 2010]

Pickett-Potter Horn

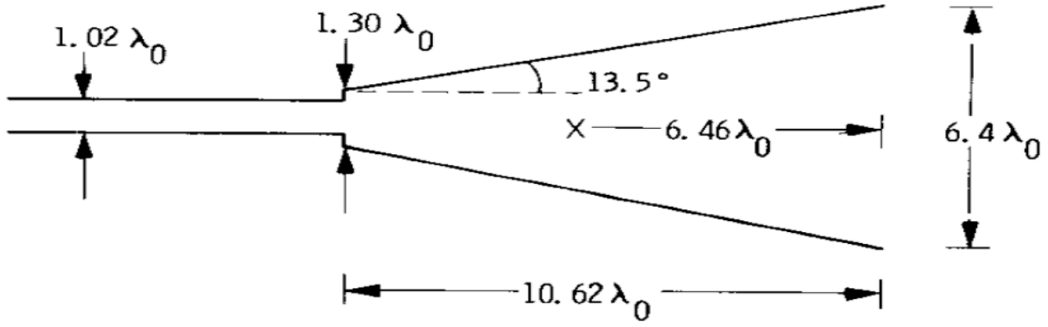


Figure 16: Design of a Pickett-Potter horn aperture [16].

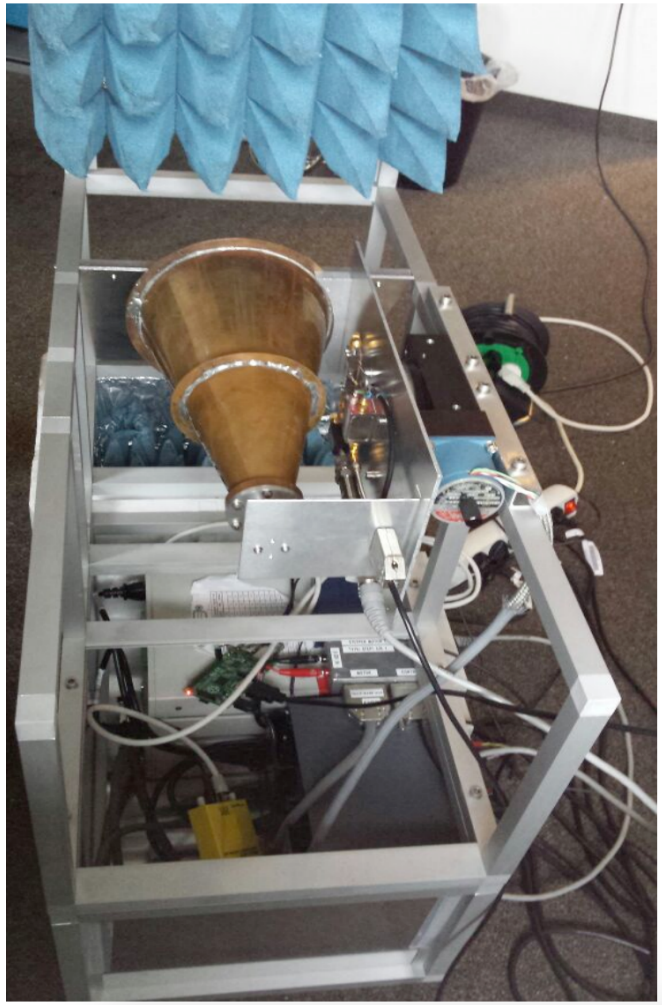
Goals of the experiment

- Receiver Temperature (you need the Y factor)
- Gain
- Effective Area
- Atmospheric opacity
- CMB temperature
- FWHM of the beam
- Satellite temperature (this depends on your dataset)

Receiver Calibration

Measuring the receiver temperature is needed to determine the noise power scale at the receiver input.

For coherent receiver systems, this requires the noise temperature increment at the receiver input to be related to the receiver output power.



This is done by connecting two or more known power sources, typically matched resistive loads of known temperature, TL (i.e. 78 K) and TH (i.e. 293 K) to the system.

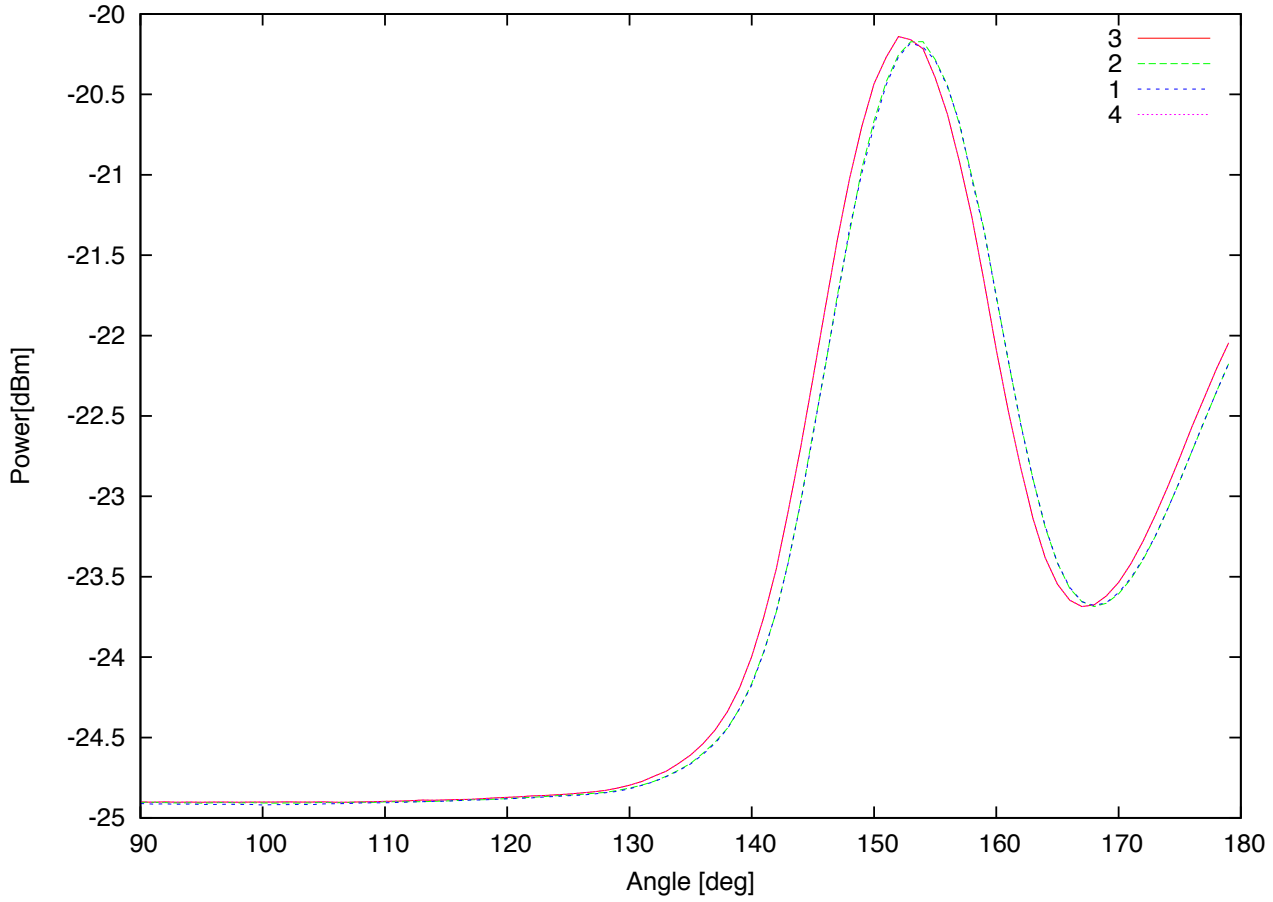
→ HOT-COLD LOAD MEASUREMENTS ←

The receiver input is related to the receiver output power via the receiver gain G.

NB
The power is given in dBm and should be converted to W

the angle should be converted in zenith angle

Once you have G you can express the power in terms of brightness temperature



From this dataset you can estimate:

Atmospheric opacity (tau)
Typical value tau ~0.01

CMB temperature

FWHM of the beam

Brightness temperature of the unresolved source