# Development of a scanning Microwave Radiometer

Matias Calderon

Dr. Hu (Tiger) Yang


# Microwave Radiometers

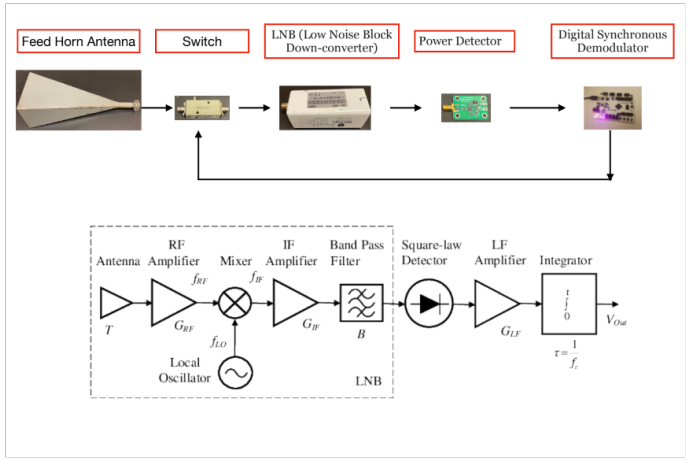


**Figure 1:** Radiometer block diagram

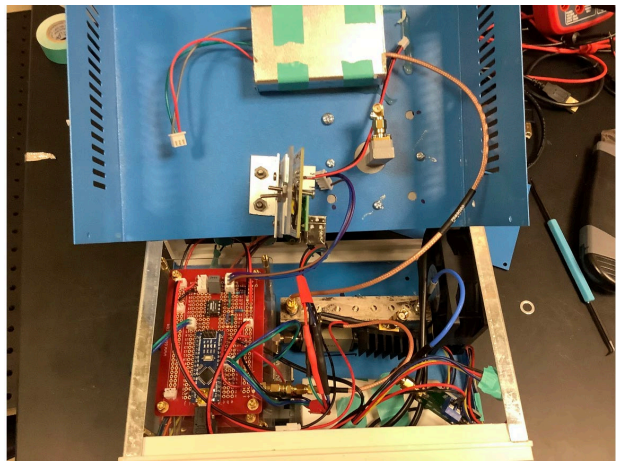

**Figure 2:** Radiometer built in our lab last summer

**Figure 3:** Previous design in field testing

- Measures the intensity of radiant energy (brightness temperature) of target object
- Atmospheric compounds can be observed individually by sampling the frequencies of microwaves they reflect.
- Due to the  properties of water vapor, we are able to detect it at our device frequency of 22.235 GHz
- Working from our previous design iteration, our new design includes remotely - controllable scanning features and noise reduction

# Scanning Reflector and Radiometer Design

- 1.5 W NEMA 17 motor to drive reflector angle
- Reflector comprised of polished aluminum adhesive-laid onto Delrin
- Stepper precision is enhanced by “homing” methods using mounted limit switch, as well as micro-stepping
- Control over rotational speed and acceleration allow us to mitigate vibrations in the reflector assembly
- Reflector scanner uses two modes: directed angle and continuous scan
- Software is written in Arduino to remain easy to understand and learn from

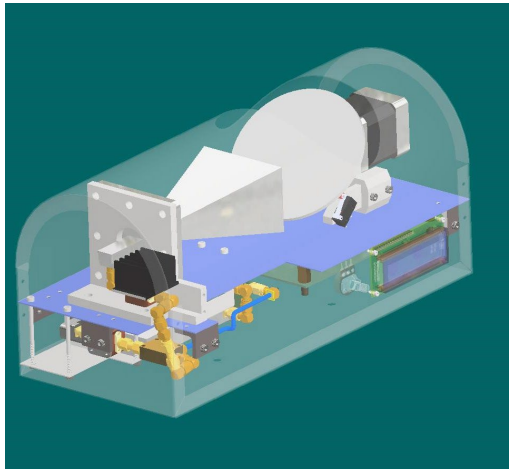

**Figure 4:** Radiometer Assembly (transparent)

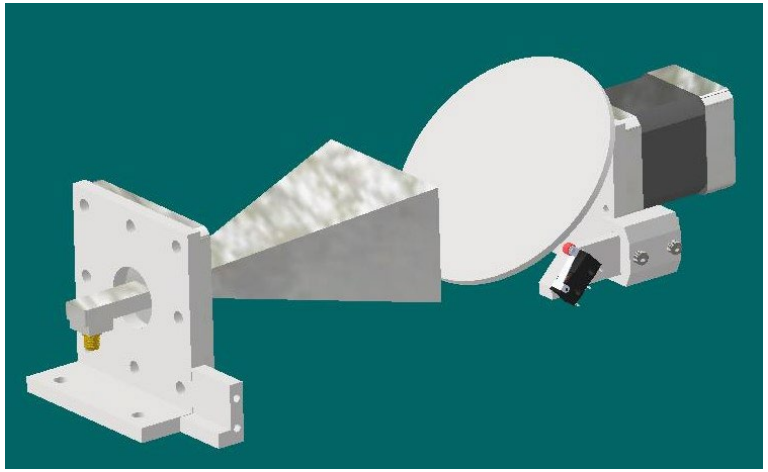

**Figure 5:** Feed Horn and Reflector alignment assembly

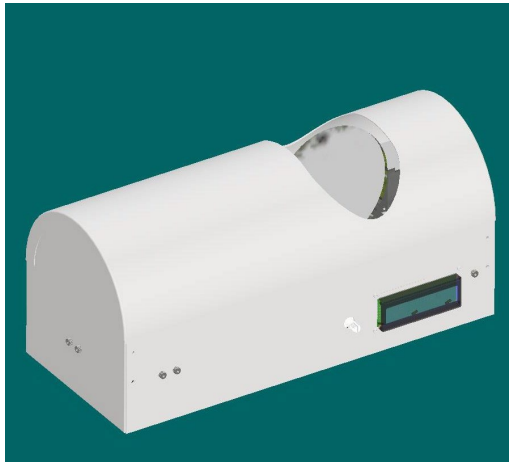

**Figure 6:** Radiometer Assembly

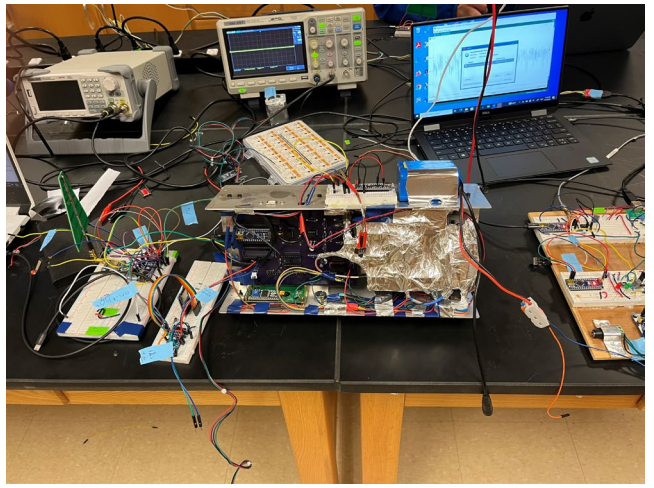

**Figure 7:** Current design assembled in lab

# Results and Next Steps

- We were able to obtain some test data (under sub-optimal conditions), and had improved data collection rate compared to our previous design
- Summer interns were successfully able to integrate wireless control into the design
- Radiometer produced with ~$5000 of off-the-shelf commercially available components.
- Limit switch method successful in mitigating step loss and other inaccuracies, with a maximum loss of .25 steps/sweep.
- We will continue testing our current model over the coming weeks and will integrate communication components into our existing PCB.
- More testing under more optimal conditions