

LOW-COST  
PERSONAL  
SPACE  
WEATHER  
STATION  
UPDATE

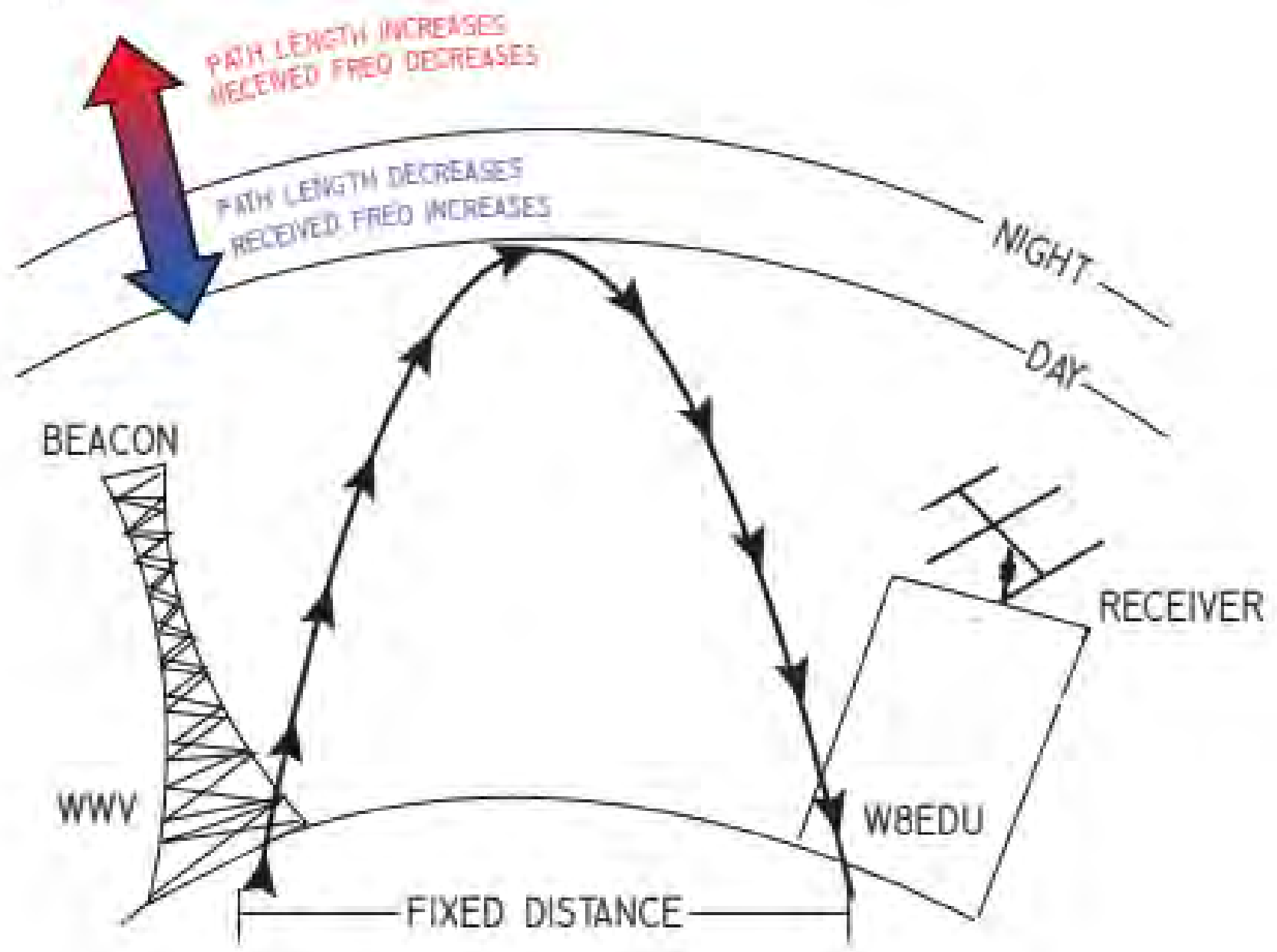


HamSci

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Case Amateur Radio Club, W8EDU

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# THE DATA COME FROM A FAIRLY *QUOTIDIEN* STATION



Linux laptop  
30 year old transceiver  
Rigblaster interface  
Some wire trailing into the attic

The system is, in effect, a low-IF SDR. Here, it is measuring a WWV carrier frequency with an IF of 1KHz.

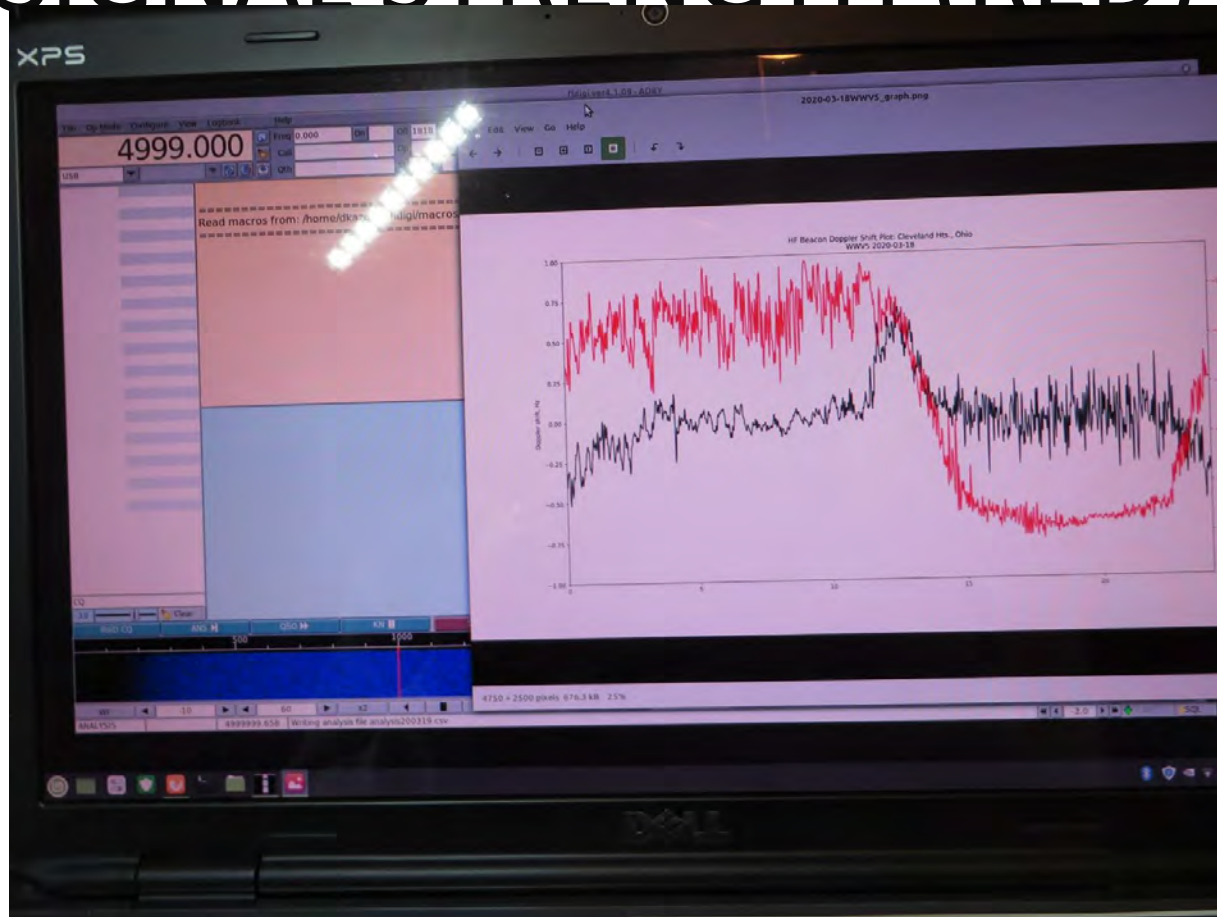


OSCILLATORS RUN OFF ONE 20 MHZ-DRIVEN DDS CHIP. THE INTERNAL CRYSTAL OSCILLATOR WAS REPLACED WITH A



GPSDO interferes with 5&10 MHz. I need to improve the shielding! The frequency stability and accuracy with GPS off are still adequate for this data collection.

# COMPUTER RUNS FLDIGI AND IS SHOWING A 5 MHZ WWV DOPPLER GRAPH (BLACK) AND SIGNAL STRENGTH (RED)

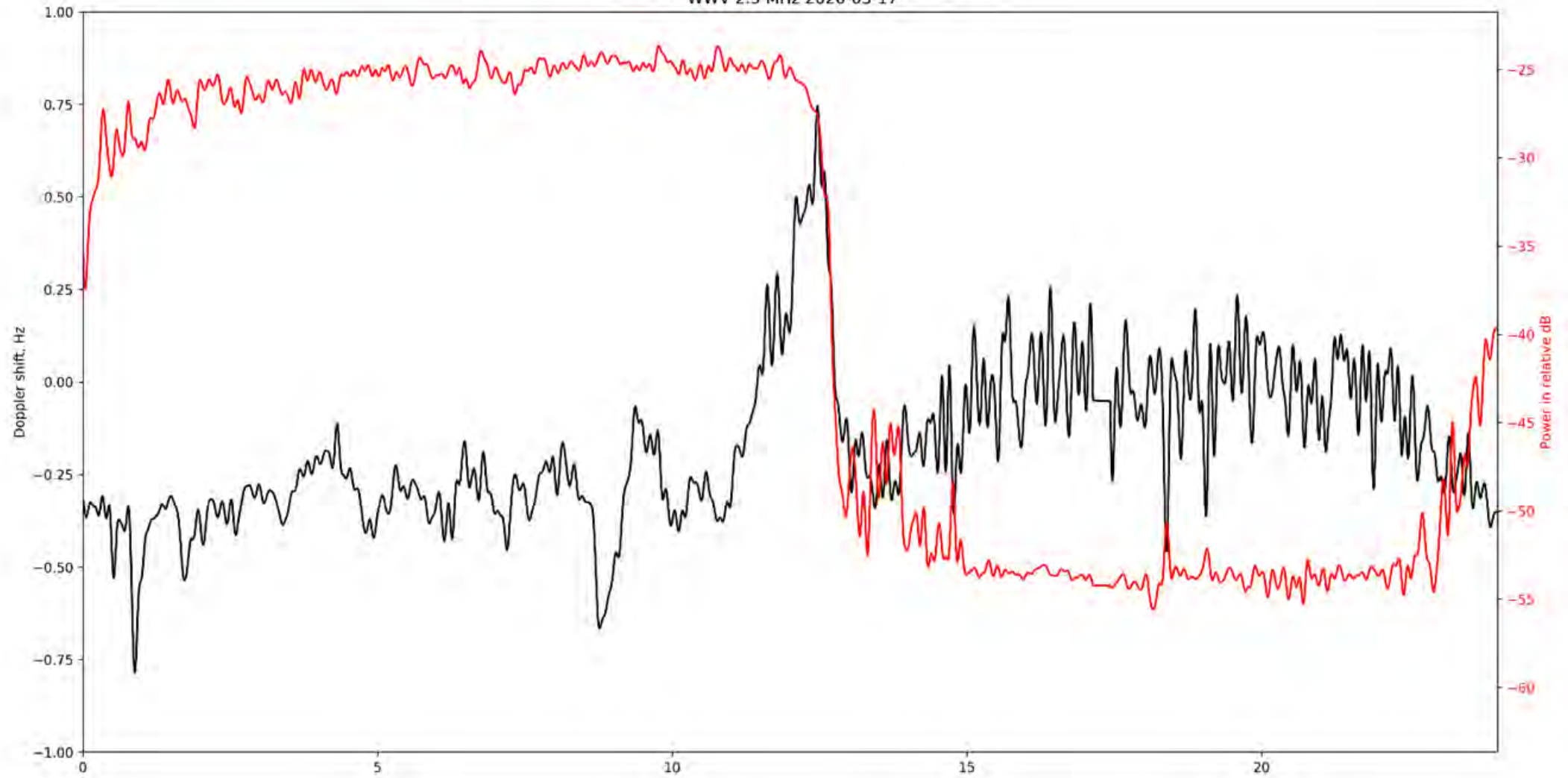


The graph is lowpass filtered at 0.1 Hz.

Time is one UTC day, so center-screen events are local sunrise; right side is around local sunset.

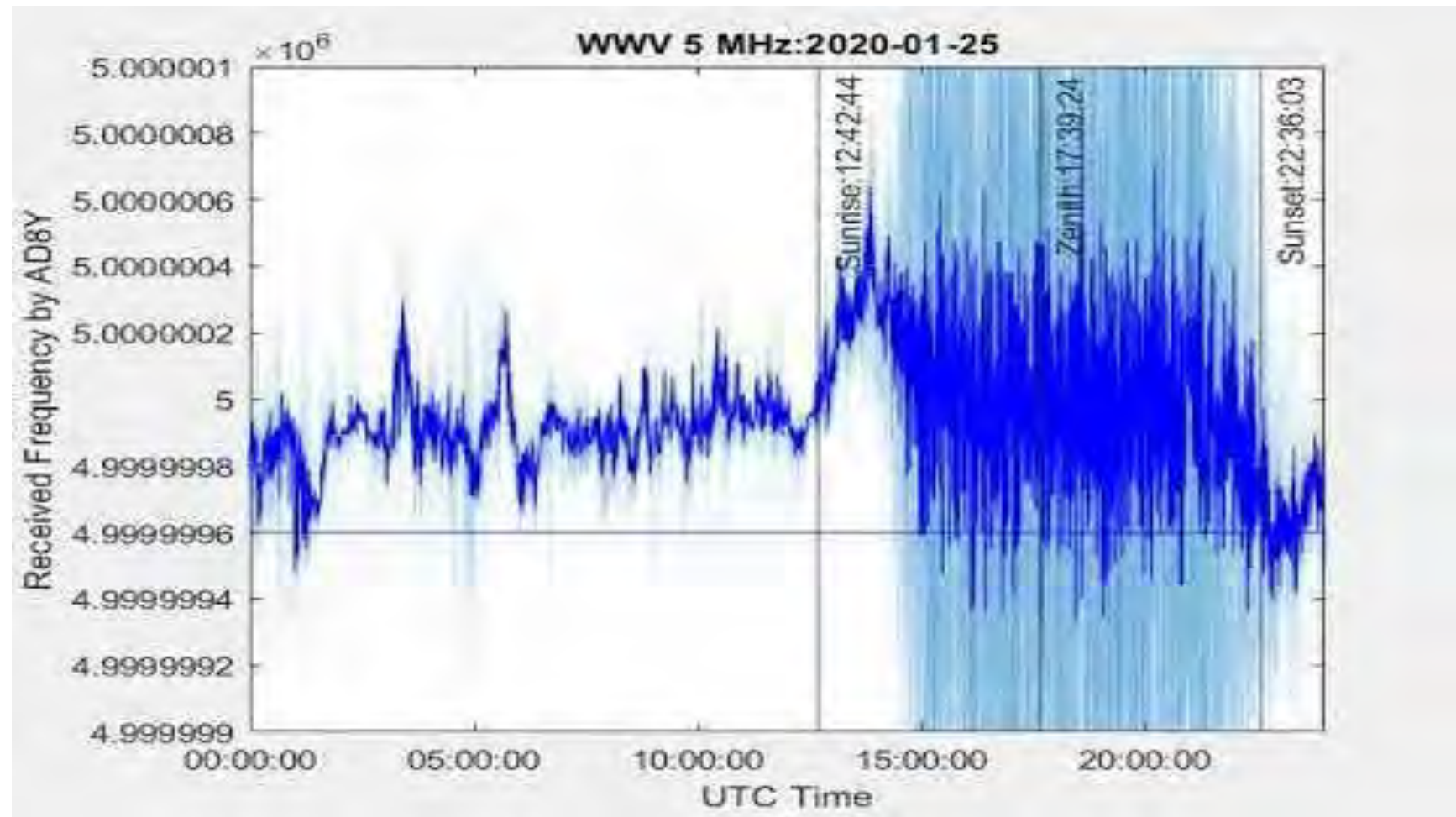
Antenna is pretty bad in this setup, just some wire jumbled into the attic.

HF Beacon Doppler Shift Plot: Cleveland Hts., Ohio  
WWV 2.5 MHz 2020-03-17



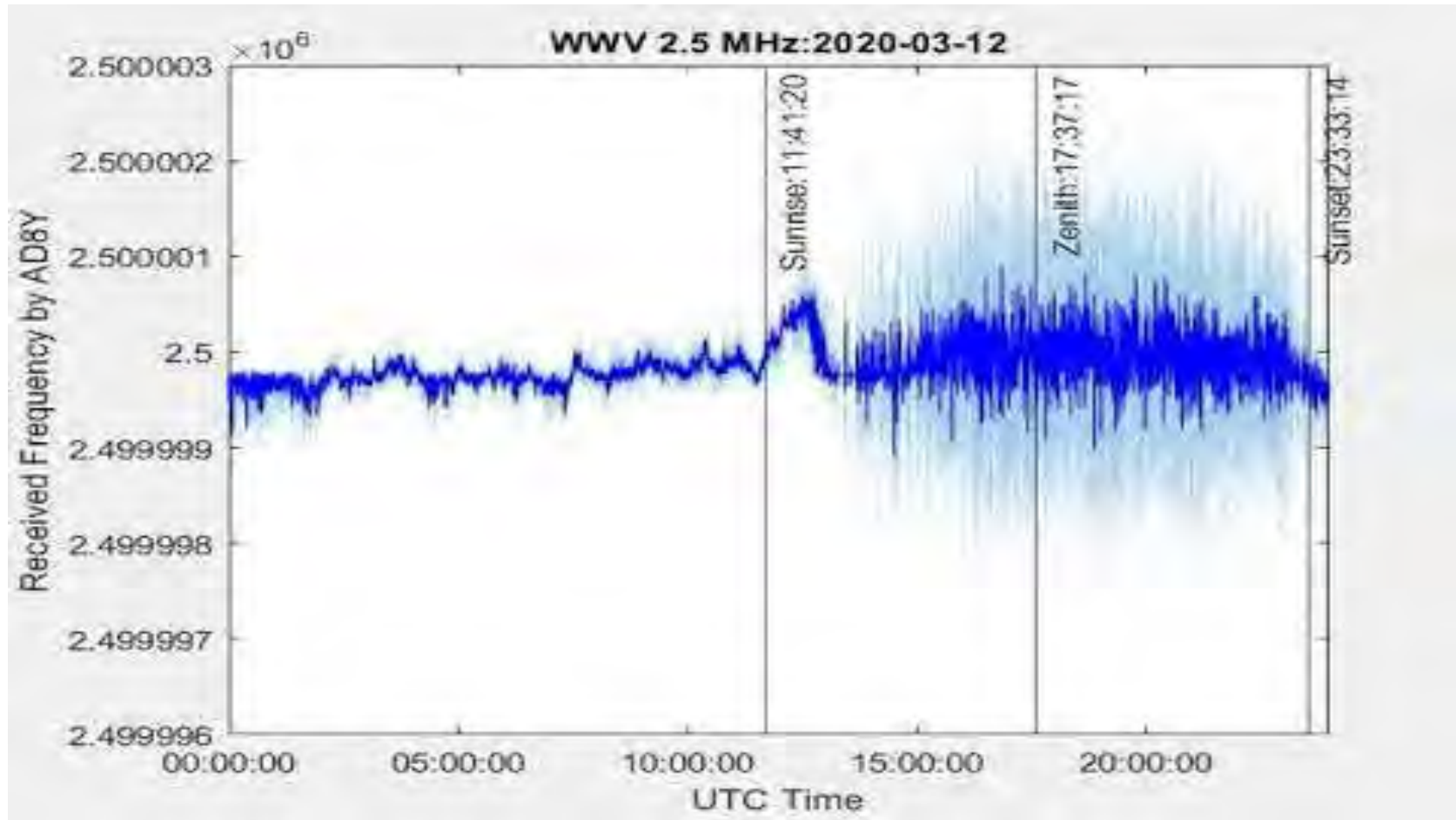


# 5 MHZ DATA:



<https://www.youtube.com/watch?v=2aHq1Q2bh5>

# 2.5 MHZ DATA:



<https://www.youtube.com/watch?v=VaizszcY8>

IF



# LOCAL SOFTWARE INCLUDES FLDIGI, PYTHON CODE, CRONTAB TIMINGS

fldigi analysis.cxx as modified by John Gibbons N8OBJ

- ❓ date and timestamps the data file
- ❓ saves it in a WWV data directory
- ❓ Has some robustness for data loss

## Python code

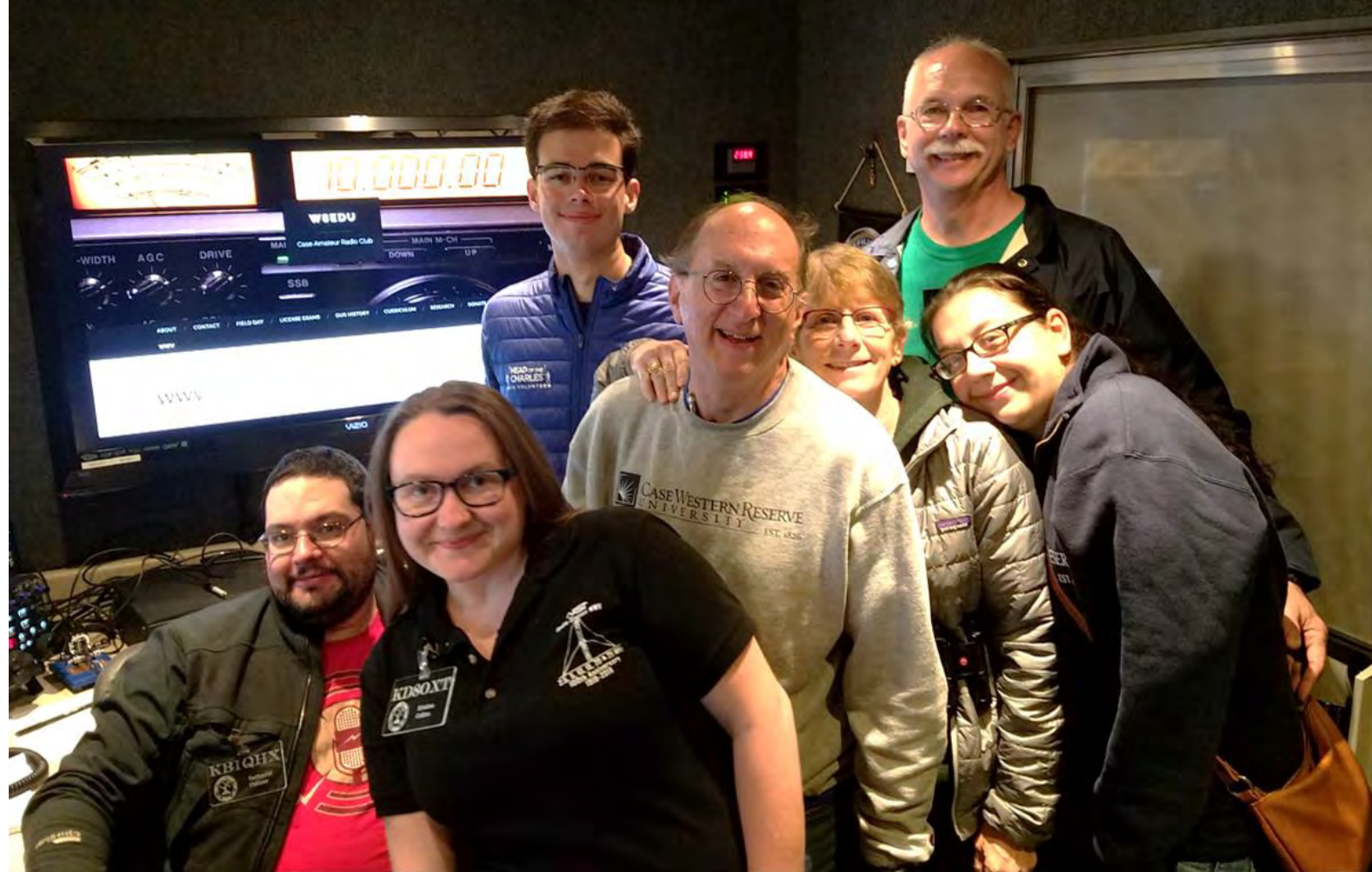
- ❓ names and stores completed data files by beacon (WWV or CHU, frequency)
- ❓ Does some statistical checks and error correction (from interruptions)
- ❓ Prepares graphs

Crontab is Linux's timing daemon. Python code is called at the beginning of each UTC day to do above tasks.

# AND THE FESTIVAL OF FREQUENCY MEASUREMENT ENT

[www.www100.org](http://www.www100.org)

<https://hamsci.org/www-centennial-festival-frequency-measurements>





# WWV AND WWVB ANTENNAE









**THE FESTIVAL OF FREQUENCY  
MEASUREMENT DEMONSTRATED  
MUCH VOLUNTEER ENTHUSIASM.**

**WE WOULD LIKE TO IMPROVE AND  
SIMPLIFY THIS SYSTEM SO THAT ANY  
UNOCCUPIED RECEIVER OR  
TRANSCEIVER COULD BE COLLECTING,  
DISPLAYING, AND UPLOADING DATA:**

**THE FREQUENCY ANALYSIS NETWORK.**

# MANY, MANY AMATEUR RADIO AND SWL STATIONS HAVE A COMPUTER RUNNING FLDIGI ALREADY ATTACHED AND ARE INTERNET CONNECTED.

A small app running in the background may be all that is required.

The absolute system requirements are fairly minimal; we can remove enough systematic errors that extreme frequency accuracy isn't required at the receiver.

Requirements are even more relaxed for second-tick multipath determination if a GPSDO is available.

These results seem to satisfy the question of whether a Doppler-shift measurement personal space weather station is feasible and can obtain interesting results.

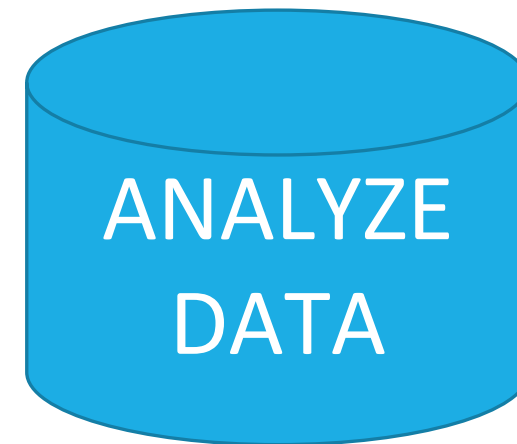
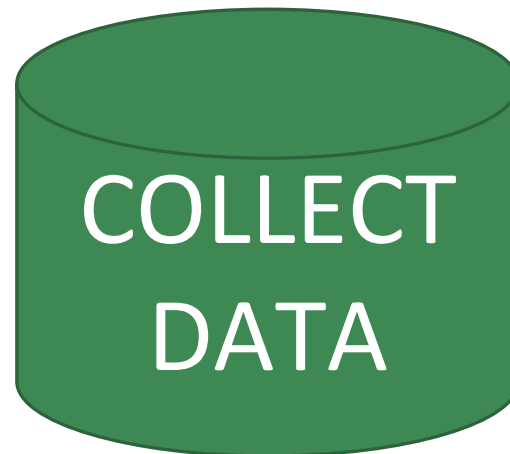
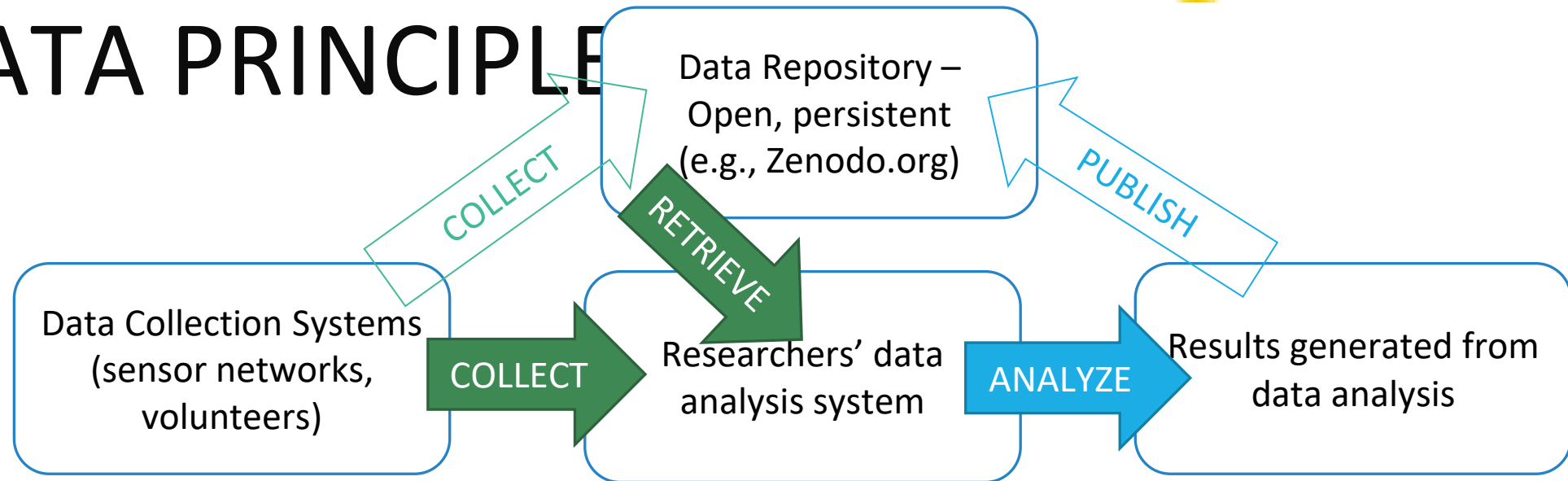
# FAIR DATA PRINCIPLE

**Findable**

**Accessible**

**Interoperable**

**Reusable**



# WANT TO COLLECT DOPPLER SHIFT DATA?

You can set up your own data collection in FLDigi.

Use the instructions composed by Aidan Montare KB3UMD for the Festival of Frequency Measurement at <https://hamsci.org/wwv-centennial-festival-frequency-measurements>

In FLDigi, use the Analysis mode. John Gibbons N8OBJ recently contributed code to improve the data collection; it will be appearing in an upcoming release.



# INTERESTED IN JOINING THE FREQUENCY ANALYSIS NETWORK?

FLDigi will now be able to collect this data in a format well-suited for uploading and analysis.

Our next step will be to set up automatic uploading of this data and metadata using the Zenodo API, and then package it in a ham-friendly way. **We could use some software help here.**

If you're interested, please reply to this interest survey:

<https://forms.gle/ucRDZbU8ZgsaE2cX8>