Cir Patch Feed Disk Yagi
Student Edition

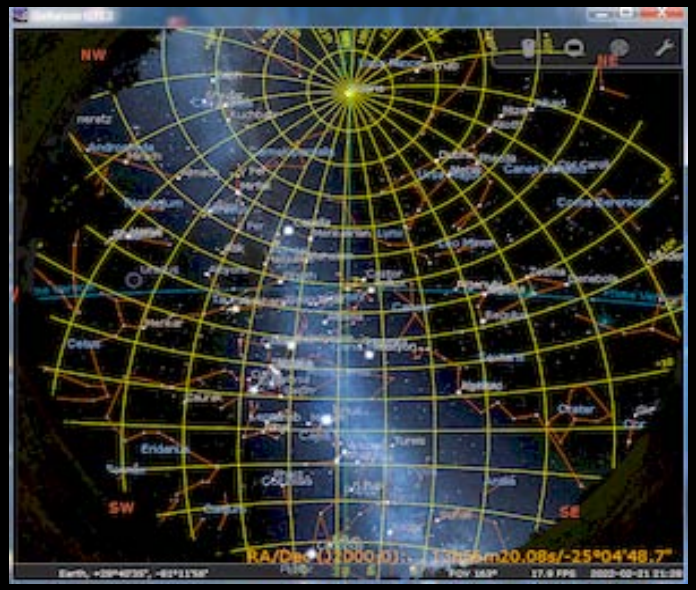
SOFTWARE

Data Acquisition
Averaging
Auto File Saving

Basic Software Hydrogen 21 cm Radio Telescope

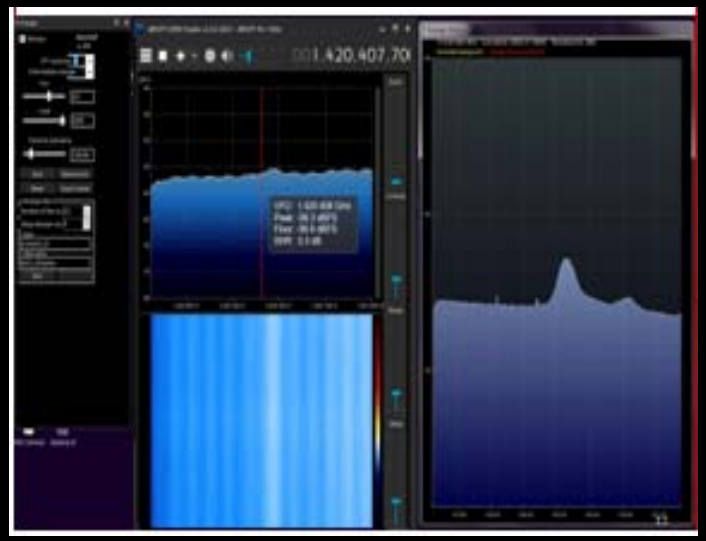
find the Milky Way

Planetarium Software
Astronomical Sky Display
Stellarium



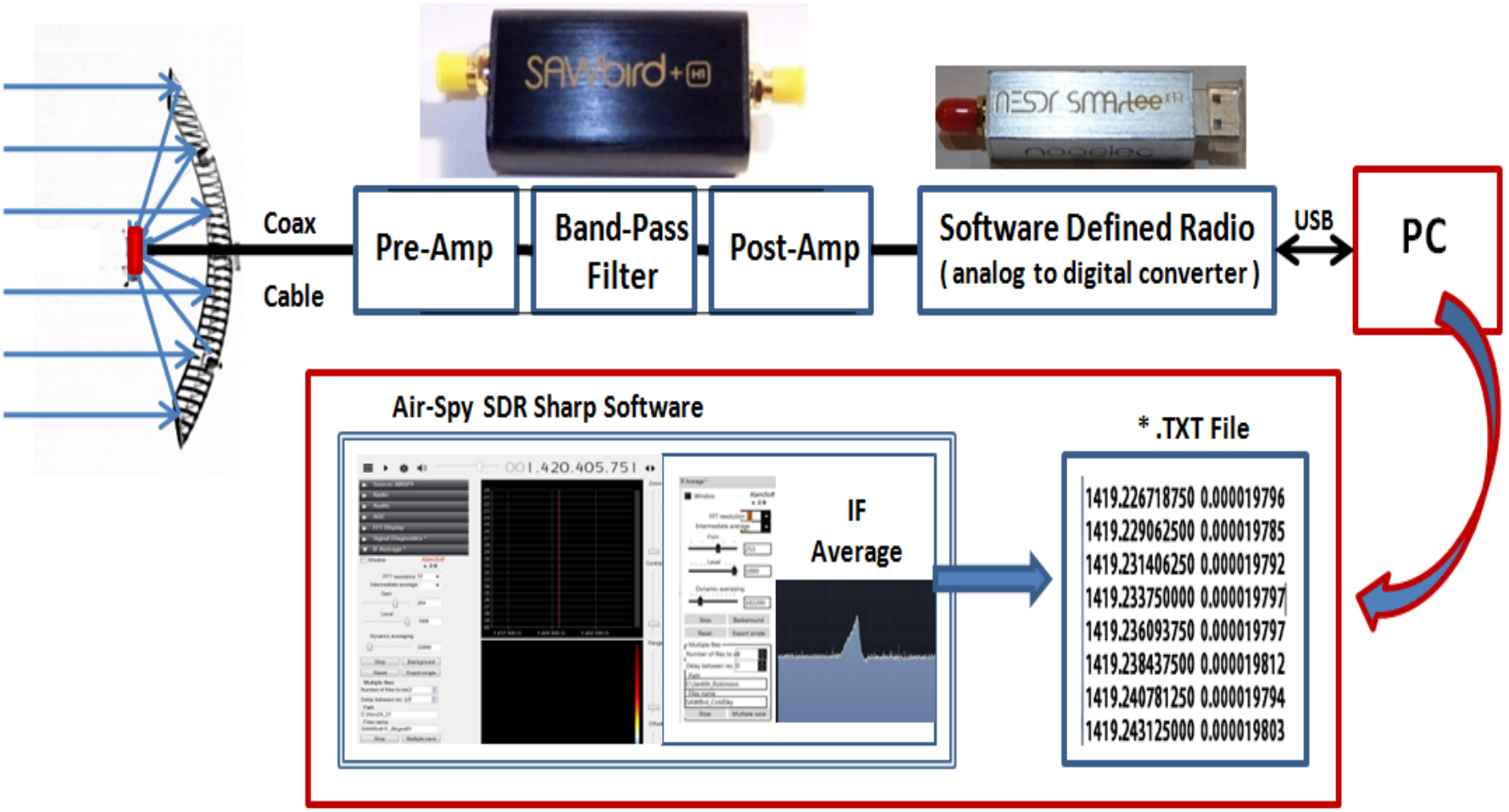
H Line Acquisition :

Air Spy
SDR Sharp Studio
IF Average Plug-In



System Hardware and Software

Hardware & Software System Block Diagram



SOFTWARE AirSpy SDR# Studio

IF_Ave Ver 2.8 PlugIn for SDR# Studio
Full Installation of SDR# & IF_Ave 2.7

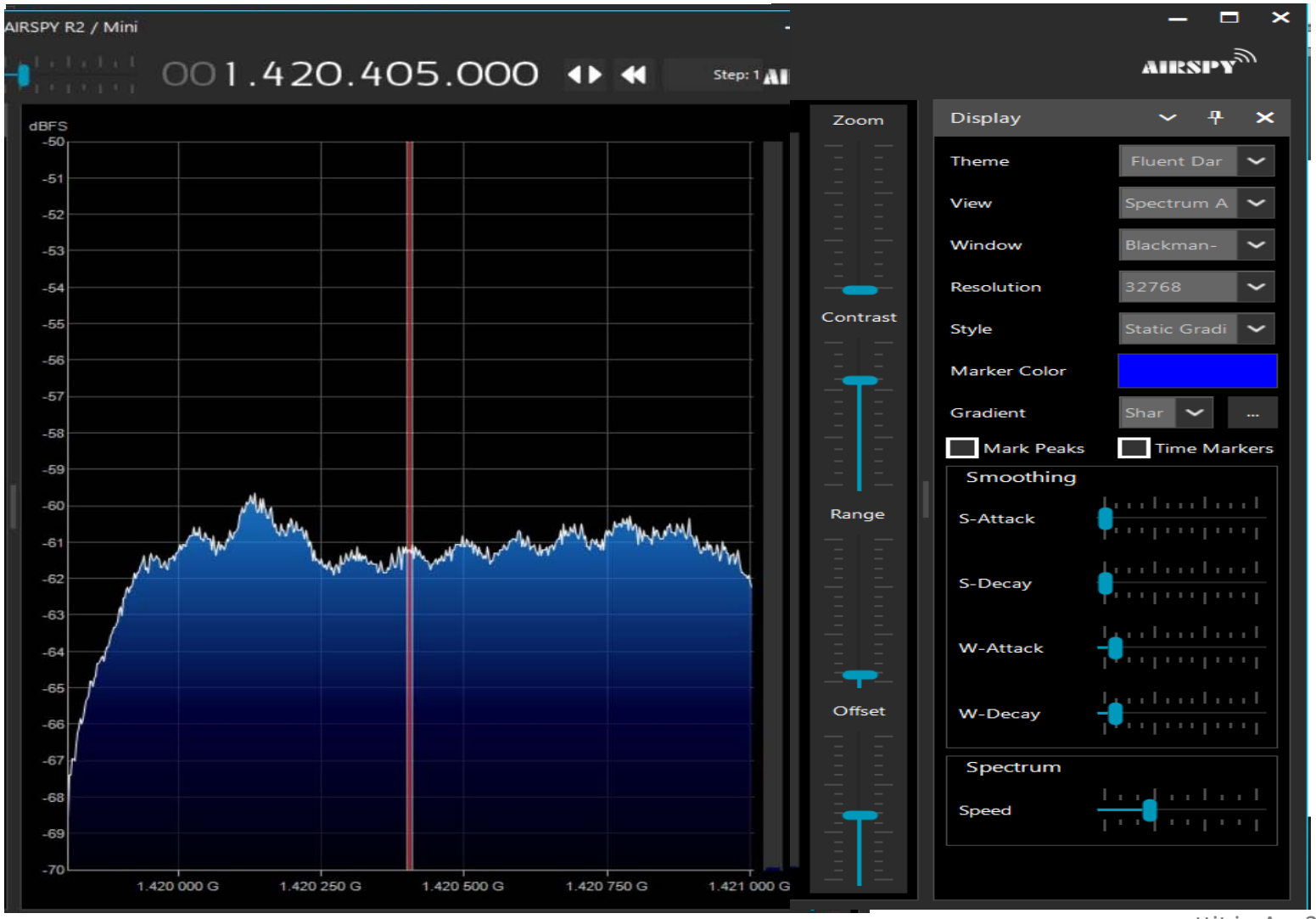
https://www.dropbox.com/scl/fi/2f67lyu6qgt2cp98rg9kp/SDR-2.ZIP?rlkey=y82yv6jzjyu7e92sap3x8ewm7&st=tcil7w3s&dl=0

The latest Rev of **IF_Ave allows**
Saving and Recalling named Background Correction Files
replace the above with this newer * DLL

IF_Ave Version 2.8
https://www.dropbox.com/scl/fi/aitn8xtookwwxm6mvybkp/SDRSharp.Average.dll?rlkey=667f4a83958krn77ie2862jxf&dl=0

SOFTWARE AirSpy SDR# Studio

Control the SDR Software Defined Radio module
Real Time Spectral Display of Data

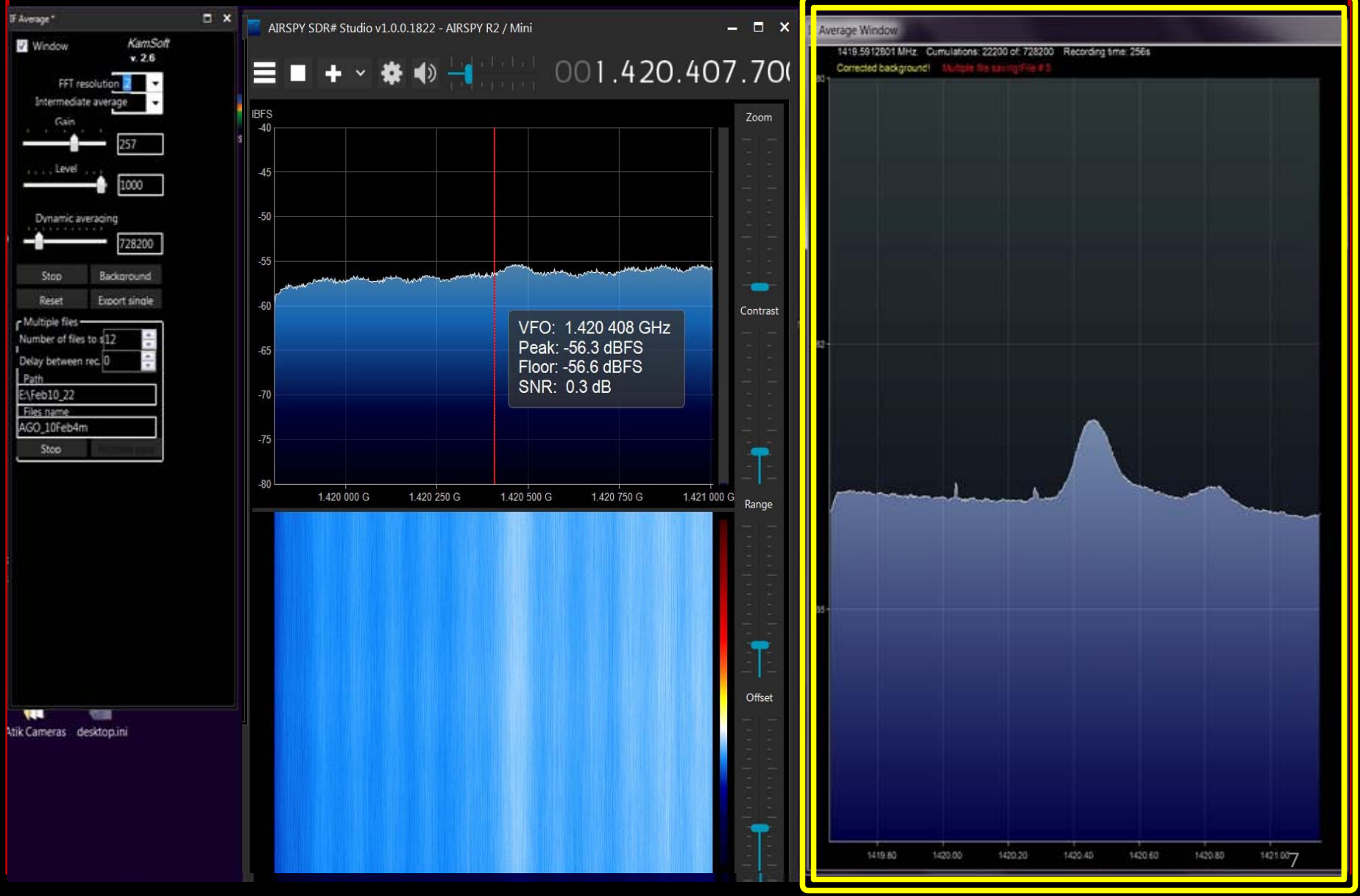


Software Block Diagram

Air-Spy SDR Sharp Software **AirSpy SDR# Studio**

Software Block Diagram

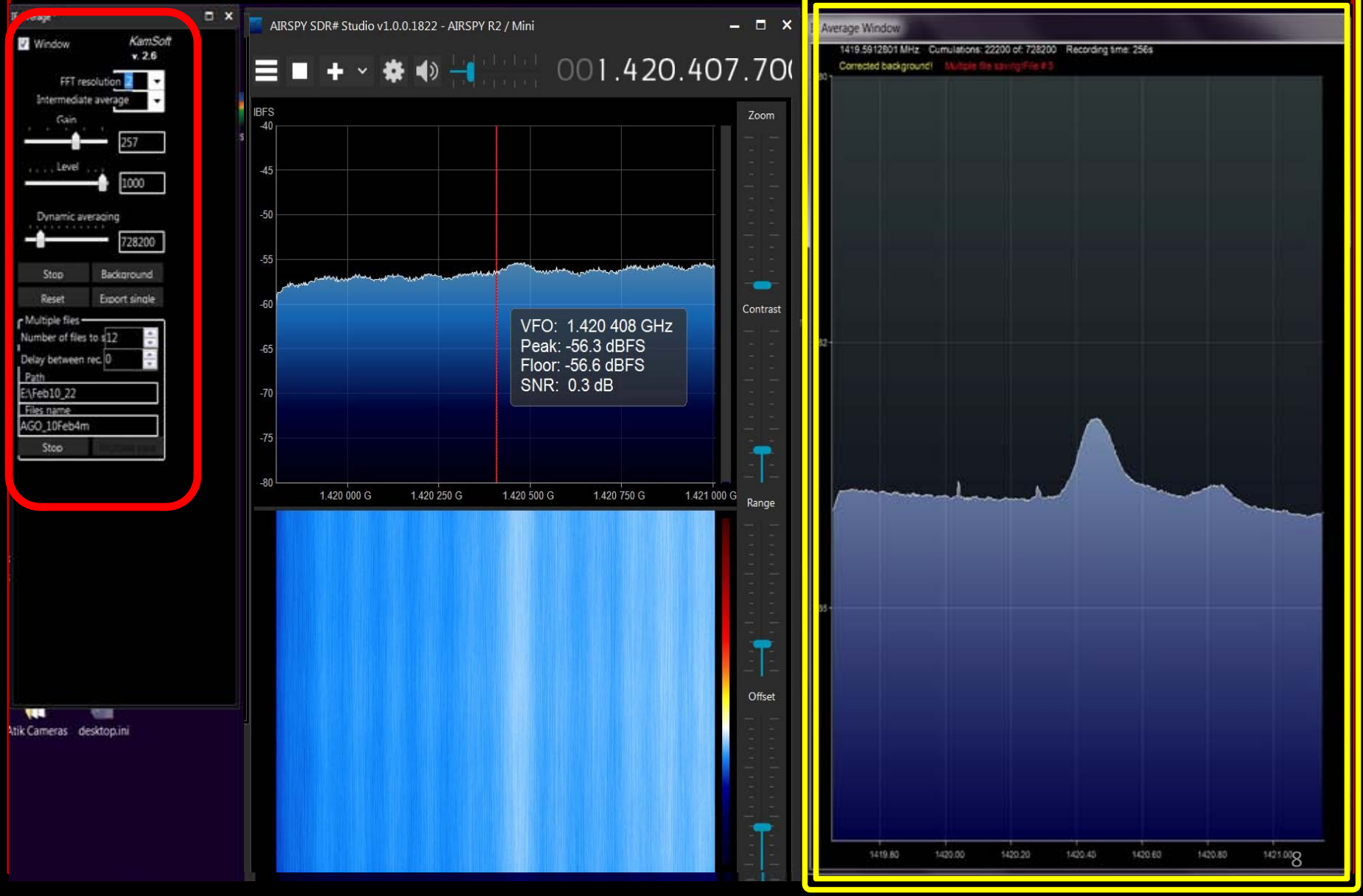
Air-Spy SDR Sharp Software AirSpy SDR# Studio & IF Average



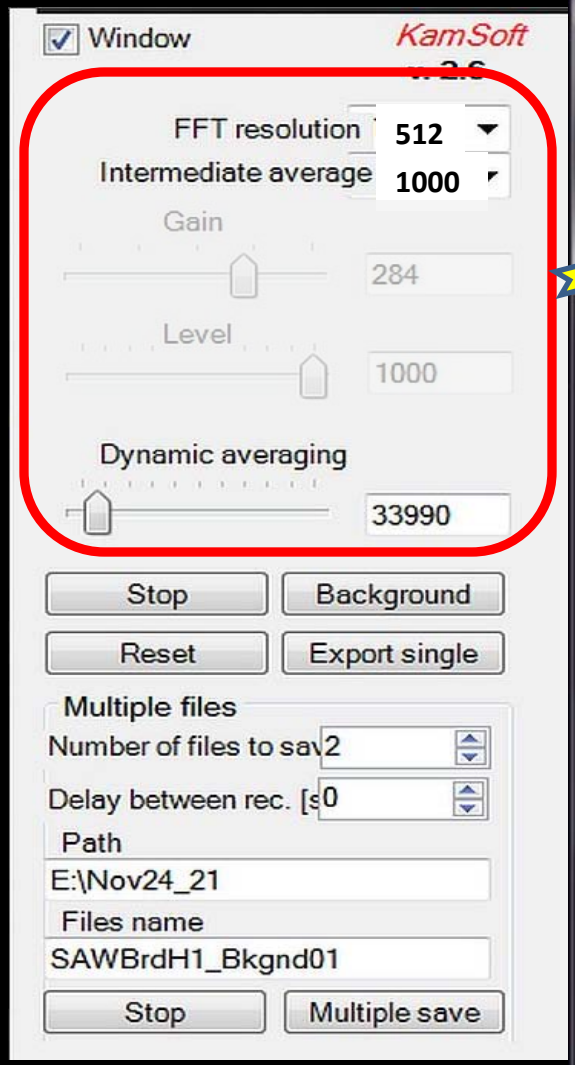
Software Block Diagram

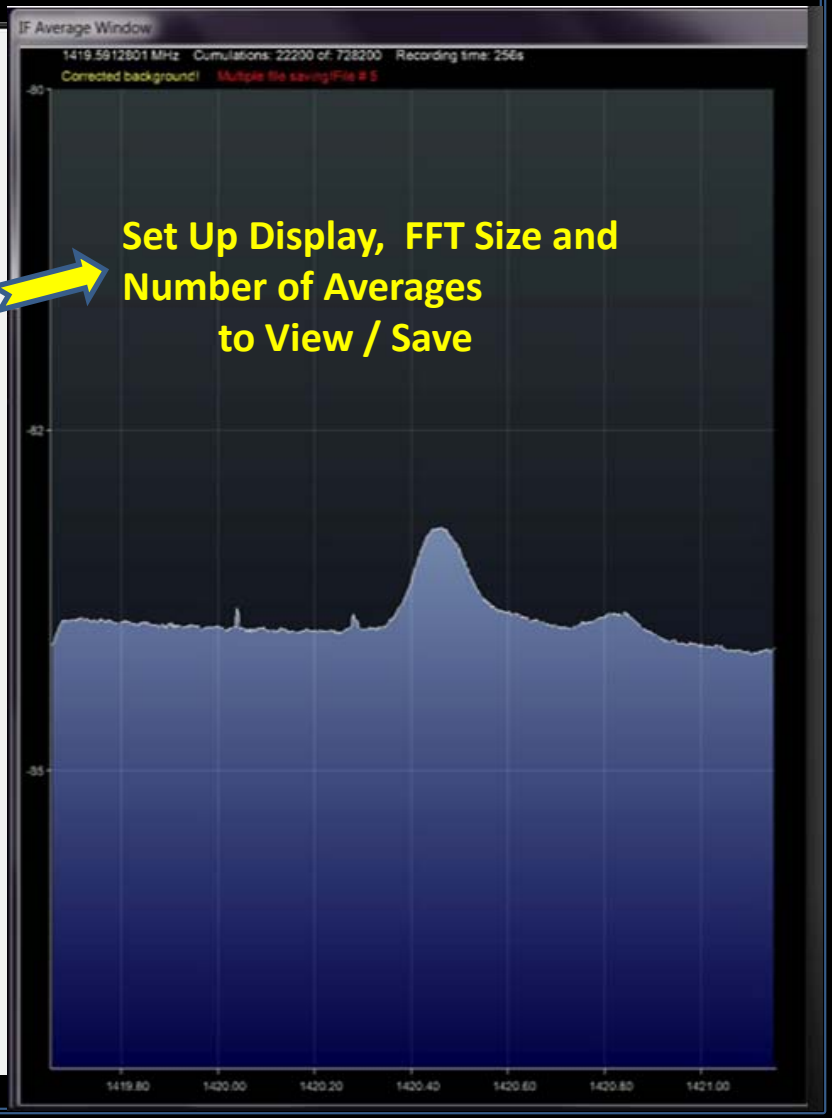
Air-Spy SDR Sharp Software

AirSpy SDR# Studio & IF Average

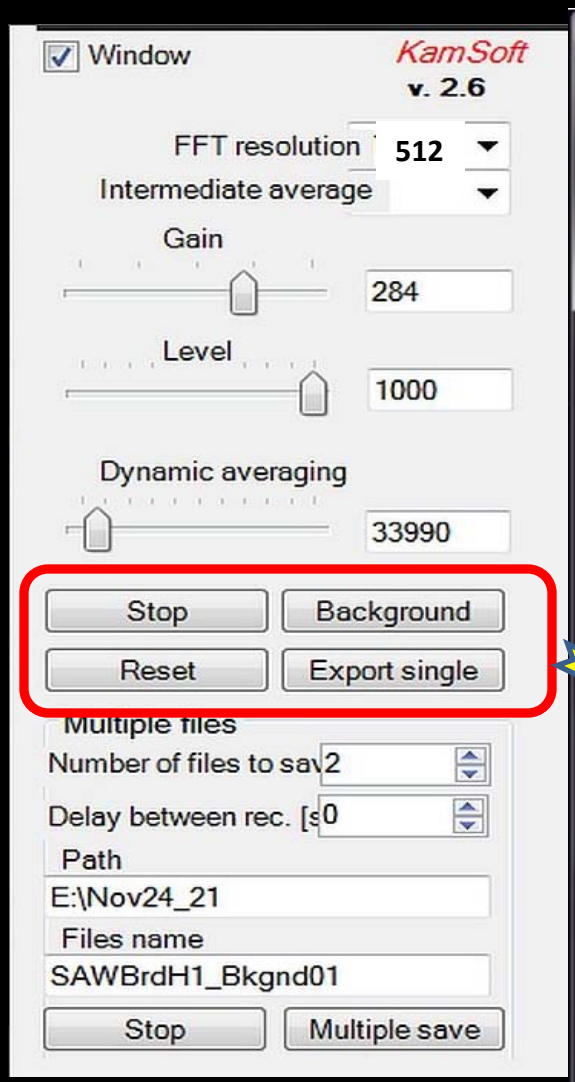


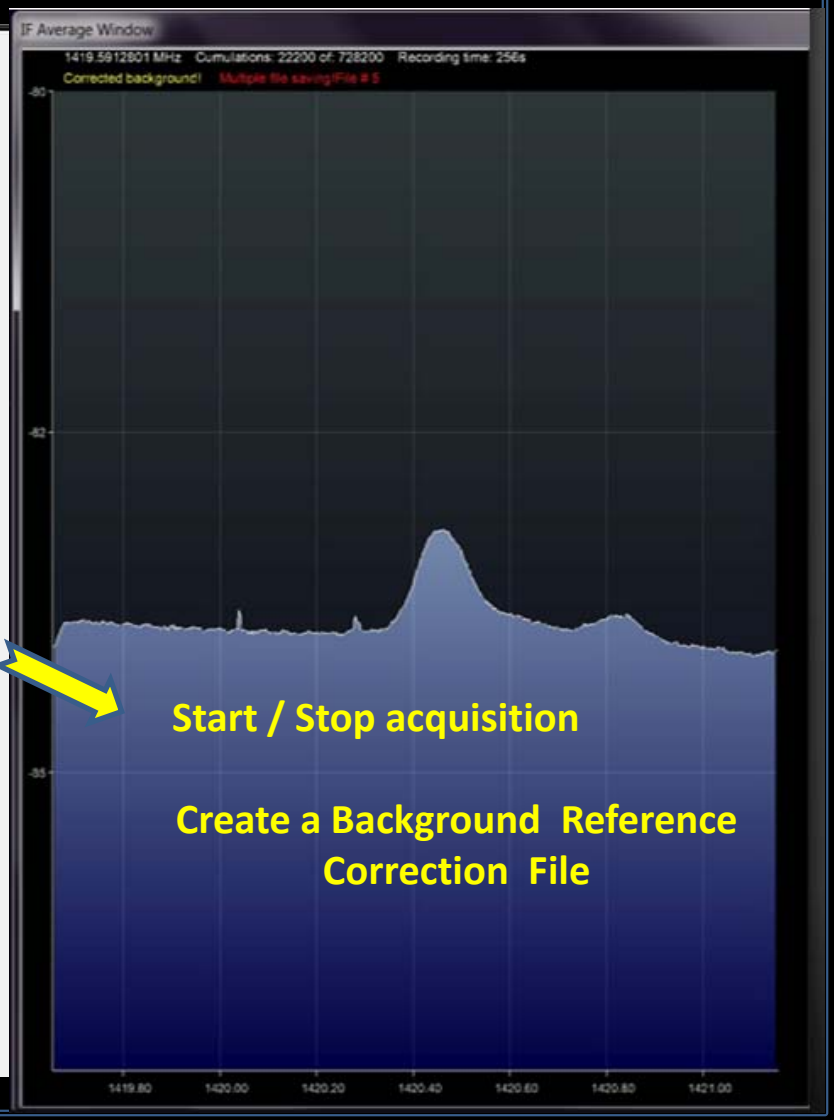
IF_Average Plug-In for AirSpy SDR# Studio



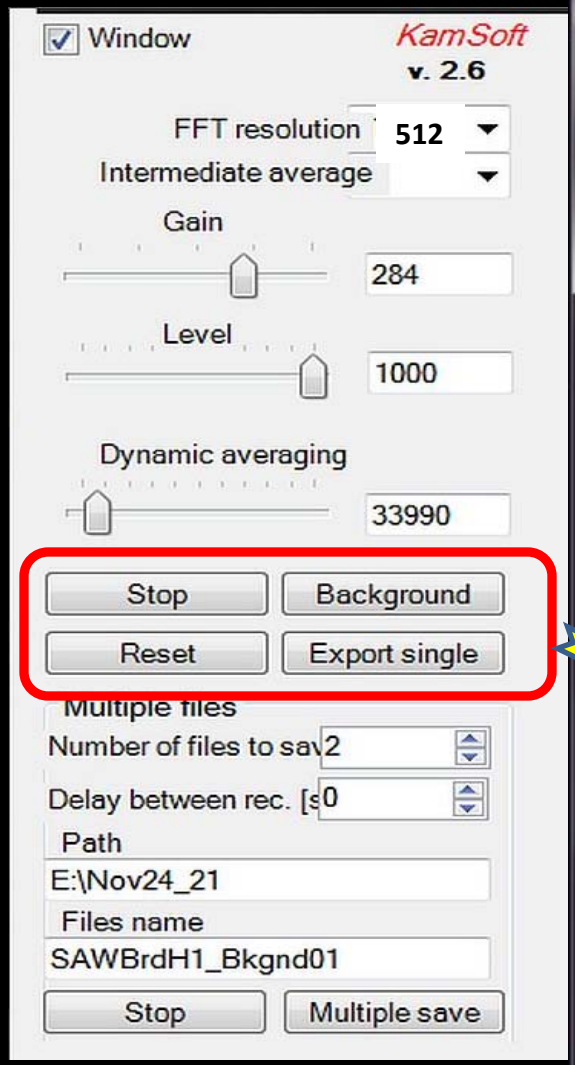


IF_Average Plug-In for AirSpy SDR# Studio

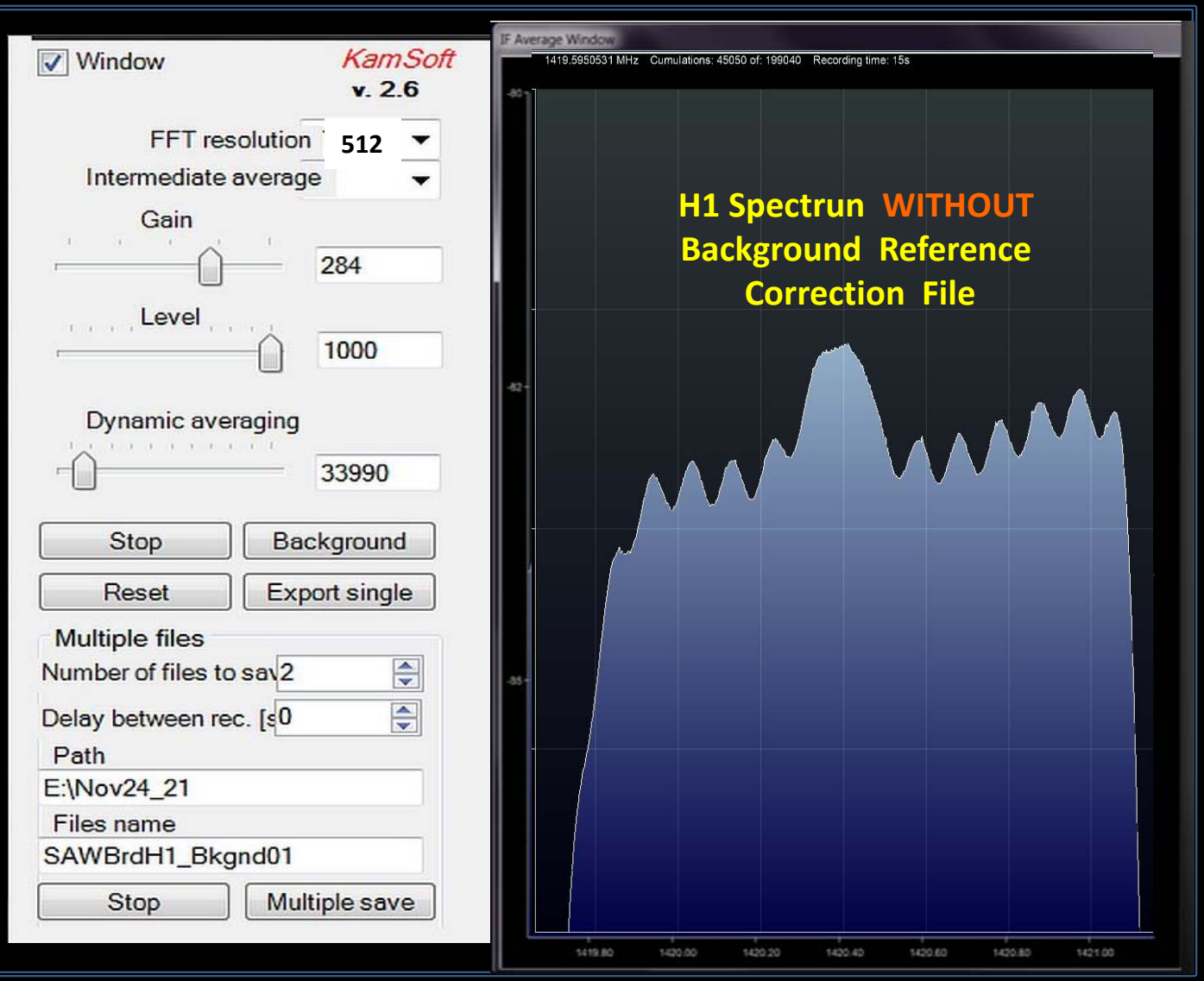




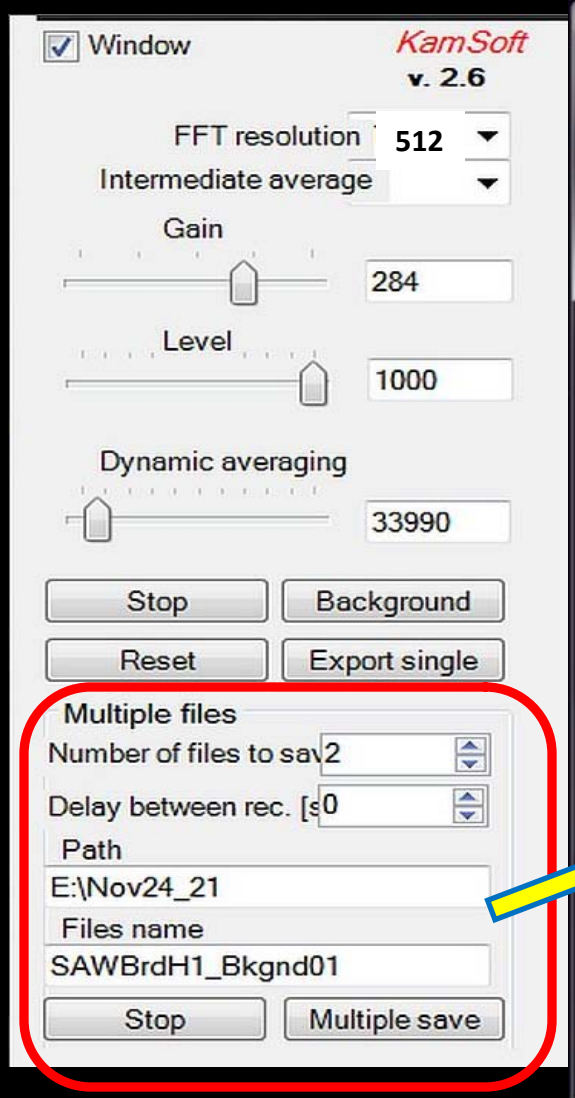
IF_Average Plug-In for AirSpy SDR# Studio

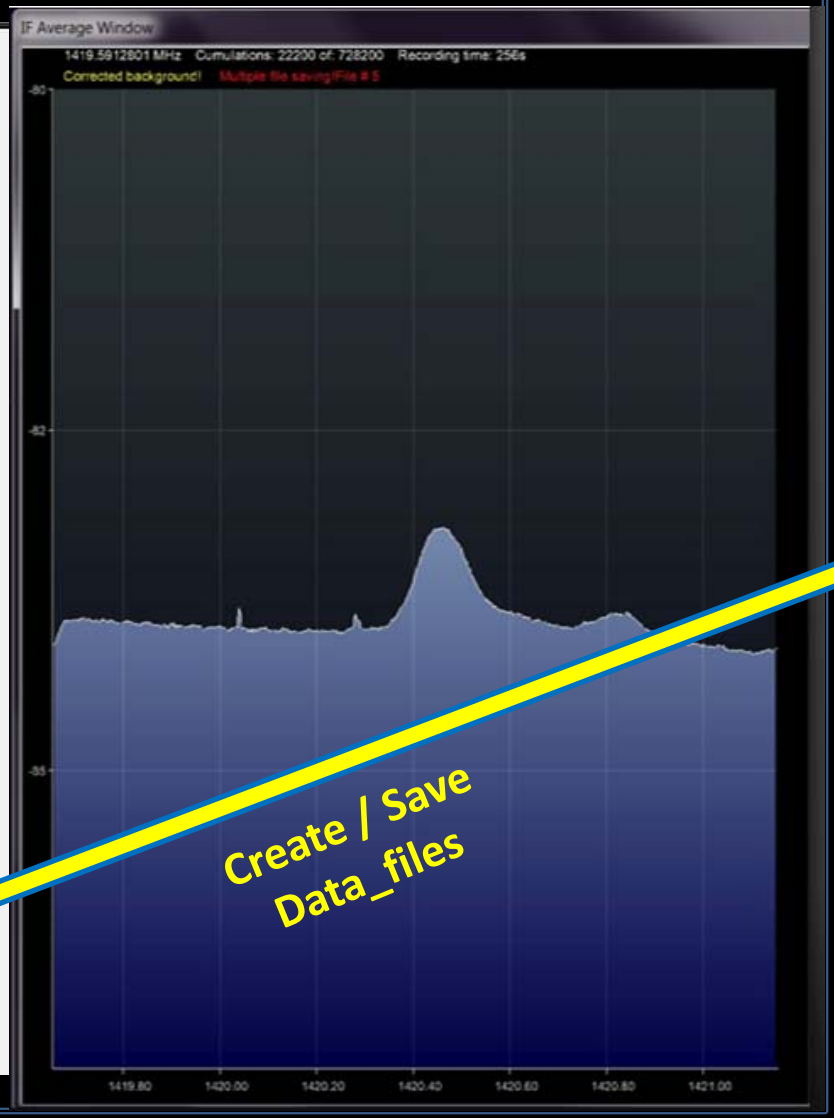


IF_Average Plug-In for AirSpy SDR# Studio



IF_Average Plug-In for AirSpy SDR# Studio

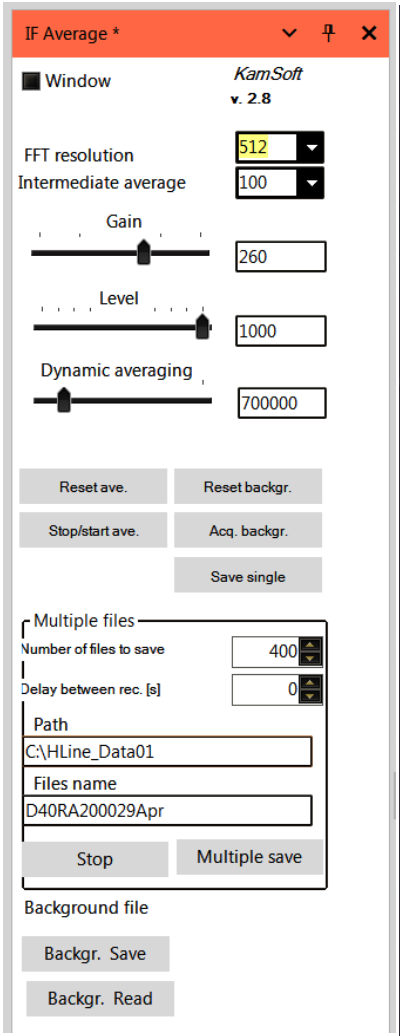


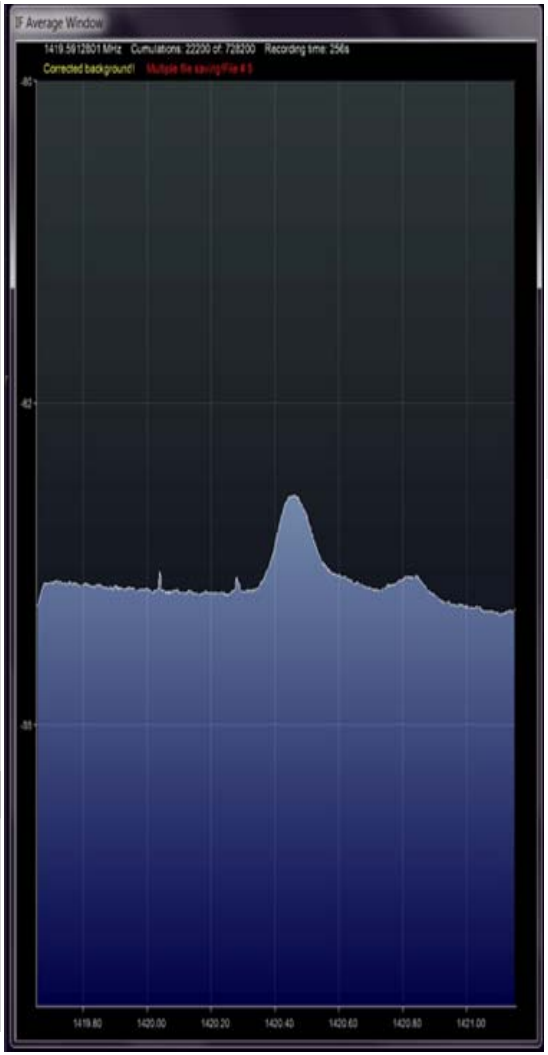


1419.650000000	0.000014132
1419.651464844	0.000014170
1419.652929688	0.000014190
1419.654394531	0.000014222
1419.655859375	0.000014283
1419.657324219	0.000014371
1419.658789063	0.000014409
1419.660253906	0.000014481
1419.661718750	0.000014577
1419.663183594	0.000014650
1419.664648438	0.000014705
[illegible]06113281	0.000014777
1419.667578125	0.000014803
1419.669042969	0.000014879
1419.670507813	0.000014919
1419.671972656	0.000014949
1419.673437500	0.000014951
1419.674902344	0.000015012
1419.676367188	0.000014986
1419.677832031	0.000014999
1419.679296875	0.000015044
1419.680761719	0.000015019

SOFTWARE AirSpy SDR# Studio

IF_Ave Ver 2.8 PlugIn for SDR# Studio
allows Setting Up Averaging, Creating a Background Correction File
and auto saving of a sequence of *.txt data files





Auto Saved Files

Name	Date modified	Type	Size
D23CPY_Dec40_0001.txt	2/25/2024 6:47 AM	Text Document	15 KB
D23CPY_Dec40_0002.txt	2/25/2024 6:51 AM	Text Document	15 KB
D23CPY_Dec40_0003.txt	2/25/2024 6:56 AM	Text Document	15 KB
D23CPY_Dec40_0004.txt	2/25/2024 7:01 AM	Text Document	15 KB
D23CPY_Dec40_0005.txt	2/25/2024 7:06 AM	Text Document	15 KB
D23CPY_Dec40_0006.txt	2/25/2024 7:11 AM	Text Document	15 KB
D23CPY_Dec40_0007.txt	2/25/2024 7:16 AM	Text Document	15 KB
D23CPY_Dec40_0008.txt	2/25/2024 7:21 AM	Text Document	15 KB
D23CPY_Dec40_0009.txt	2/25/2024 7:26 AM	Text Document	15 KB

Freq/Ampl data columns in one file

```
2/25/2024 7:47:04 AM  Count:
1419.655700000   0.000053754
1419.658629688   0.000053759
1419.661559375   0.000053886
1419.664489063   0.000053979
1419.667418750   0.000054071
1419.670348438   0.000054310
1419.673278125   0.000054432
1419.676207813   0.000054544
1419.679137500   0.000054713
1419.682067188   0.000054844
1419.684996875   0.000054961
1419.687926563   0.000055087
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1419.696715625   0.000055159
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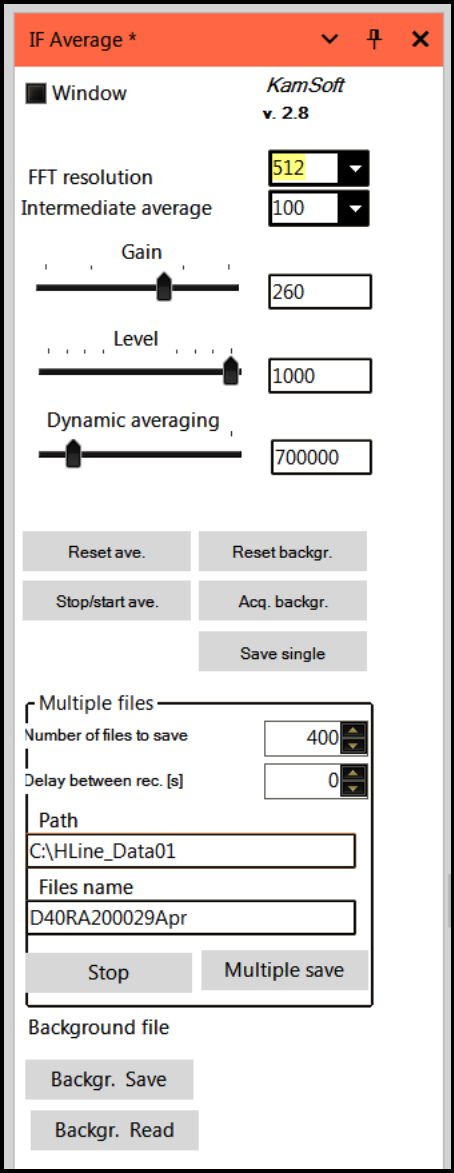
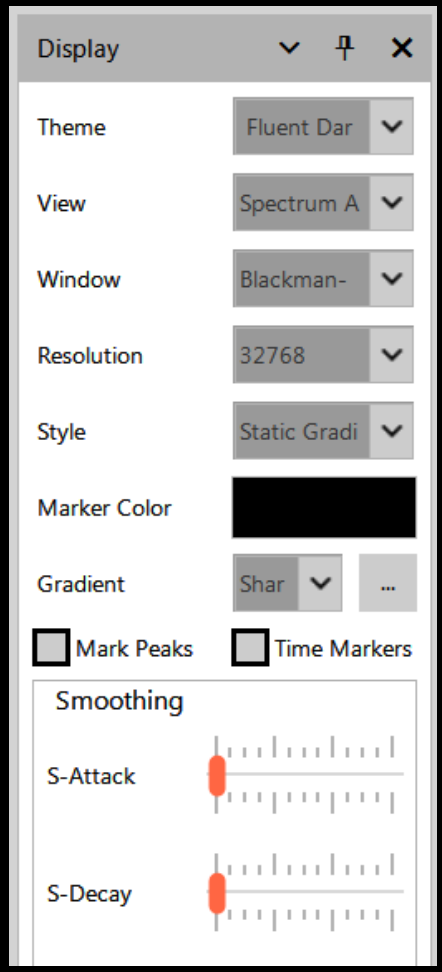
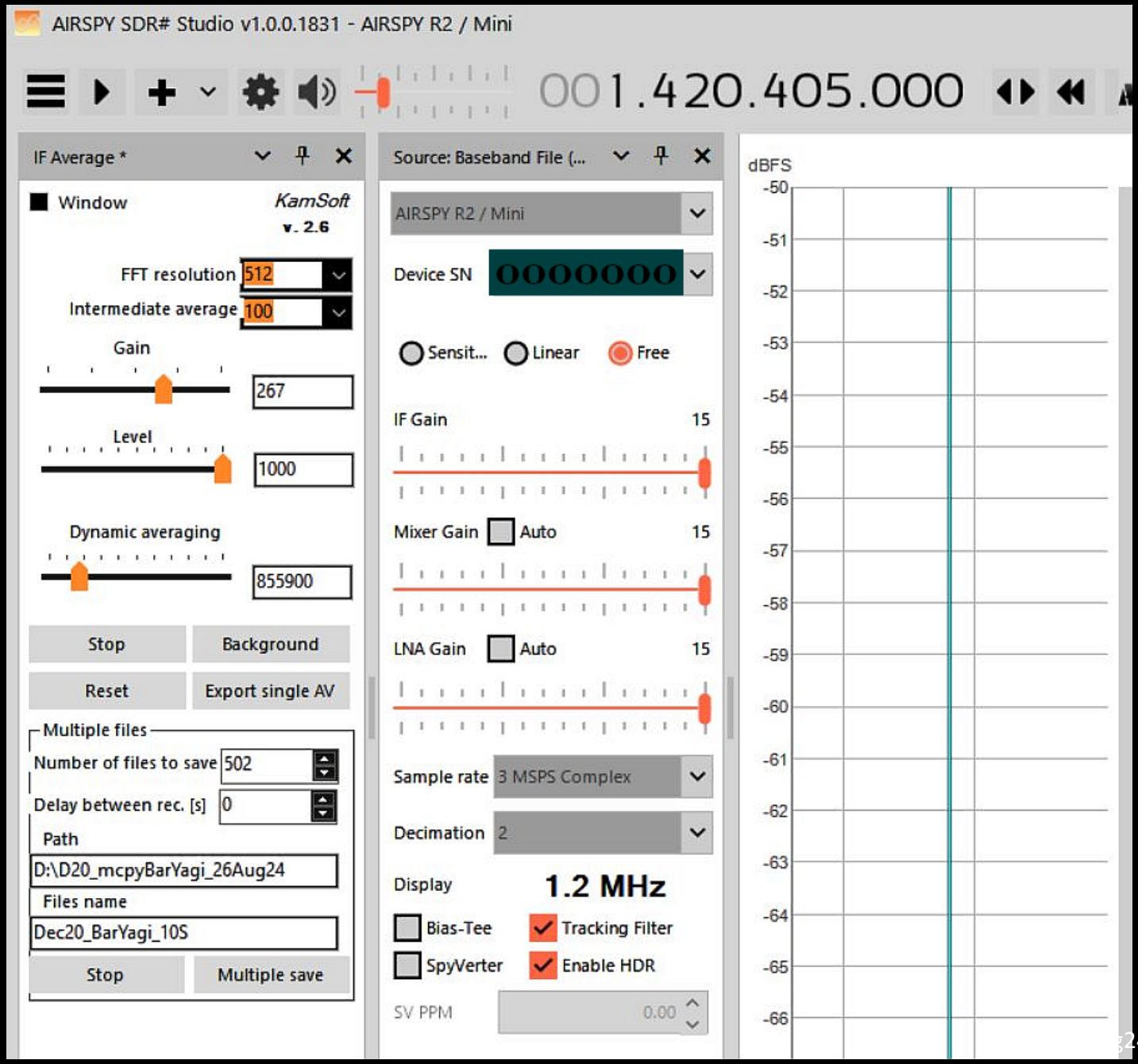
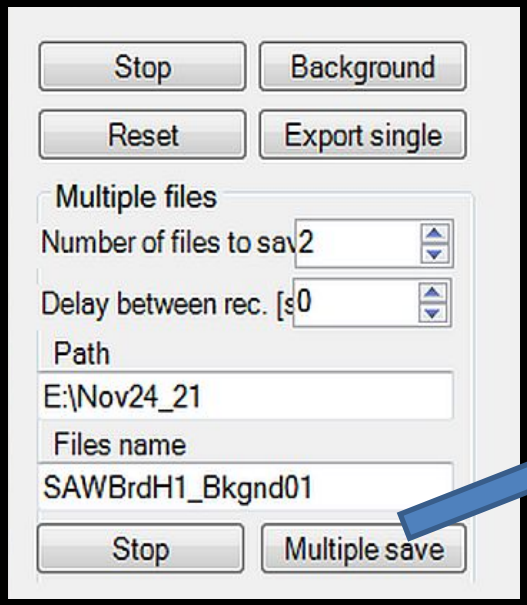


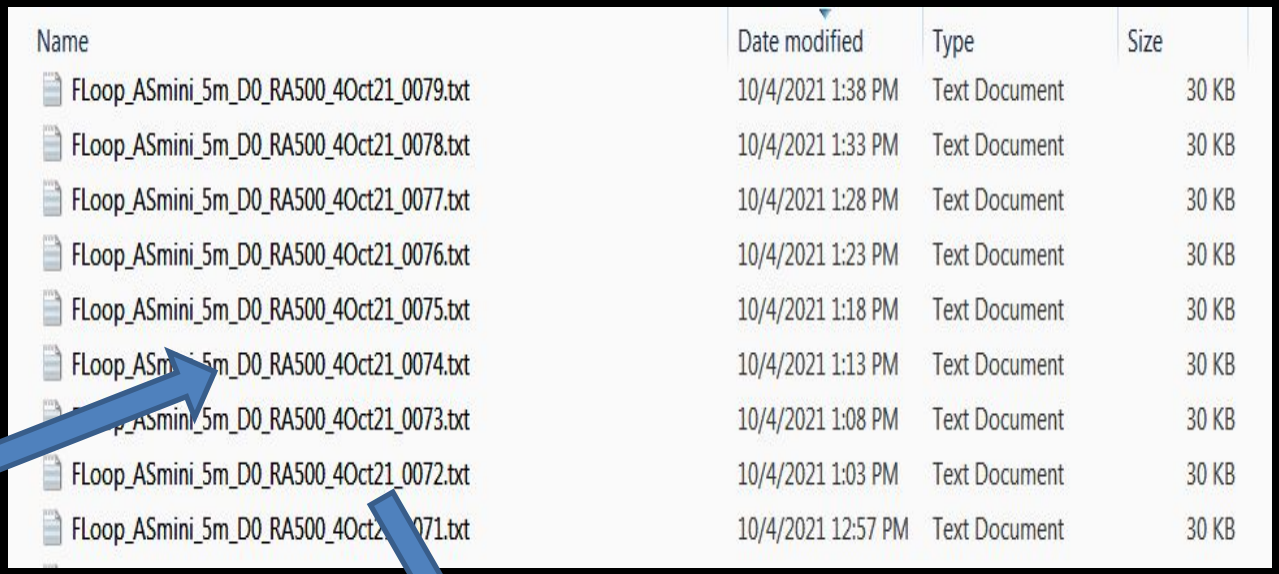


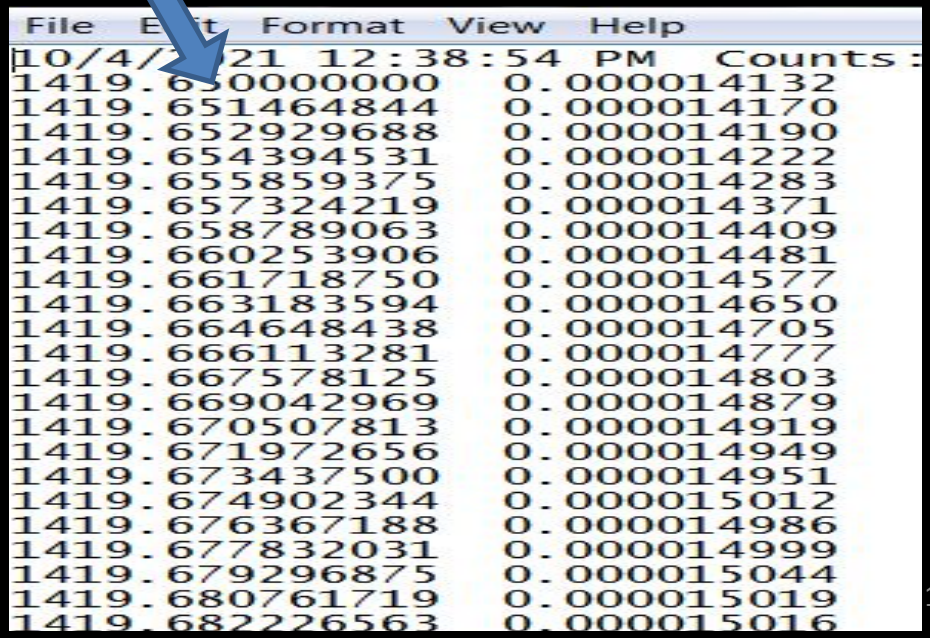
a pettit jr Aug24


AIRSPY SDR# Studio v1.0.0.1831 - AIRSPY R2 / Mini
001.420.405.000
IF Average *
Window
KamSoft
v. 2.6
FFT resolution 512
Intermediate average 100
Gain
267
Level
1000
Dynamic averaging
855900
Stop
Background
Reset
Export single AV
Multiple files
Number of files to save 502
Delay between rec. [s] 0
Path
D:\D20_mcpyBarYagi_26Aug24
Files name
Dec20_BarYagi_10S
Stop
Multiple save
Source: Baseband File (...
AIRSPY R2 / Mini
Device SN
Sensit...
Linear
Free
IF Gain 15
Mixer Gain Auto 15
LNA Gain Auto 15
Sample rate 3 MSPS Complex
Decimation 2
Display
1.2 MHz
Bias-Tee
Tracking Filter
SpyVerter
Enable HDR
SV PPM 0.00
dBFS
-50
-51
-52
-53
-54
-55
-56
-57
-58
-59
-60
-61
-62
-63
-64
-65
-66

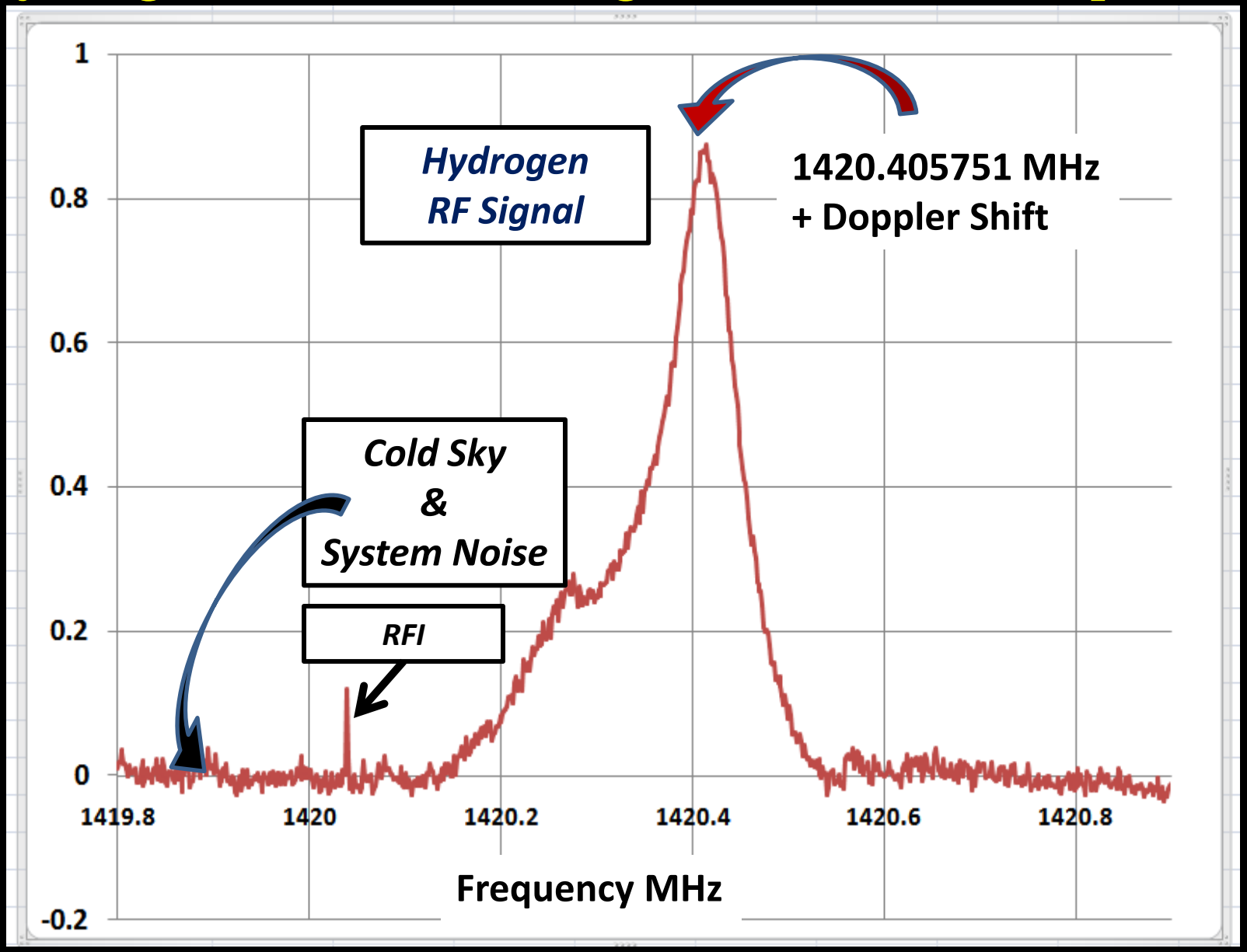
Allows FFT Size / High Count Averaging / Spectrum Saving at Selected Time Rates







Hydrogen 21-cm wavelength RF Emission Spectrum

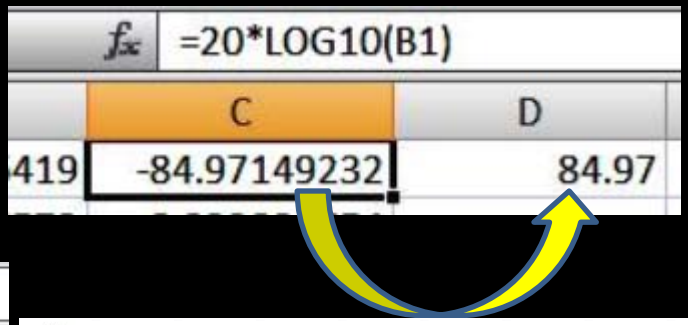


Hydrogen 21-cm wavelength RF Emission Spectrum

Convert col B to dB use the formula dB = 20*LOG10(col B values)

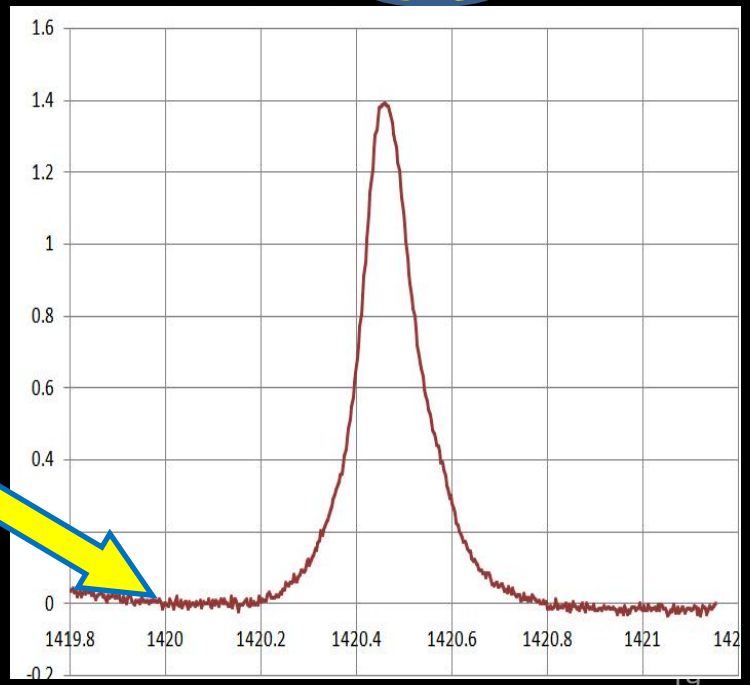
Then offset entire column by a fixed value to make Cold Sky == 0 dB (in this case 84.97)

When you first create col C, it has a large - dB value.
As a starting point put C1 value into Cell D1
Then add that fixed cell to all col C values (C1 .. C512)
Finally, Adjust as req'd to shift the Y axis.
so Cold_Sky == 0 dB



C1 =20*LOG10(B1)+D1

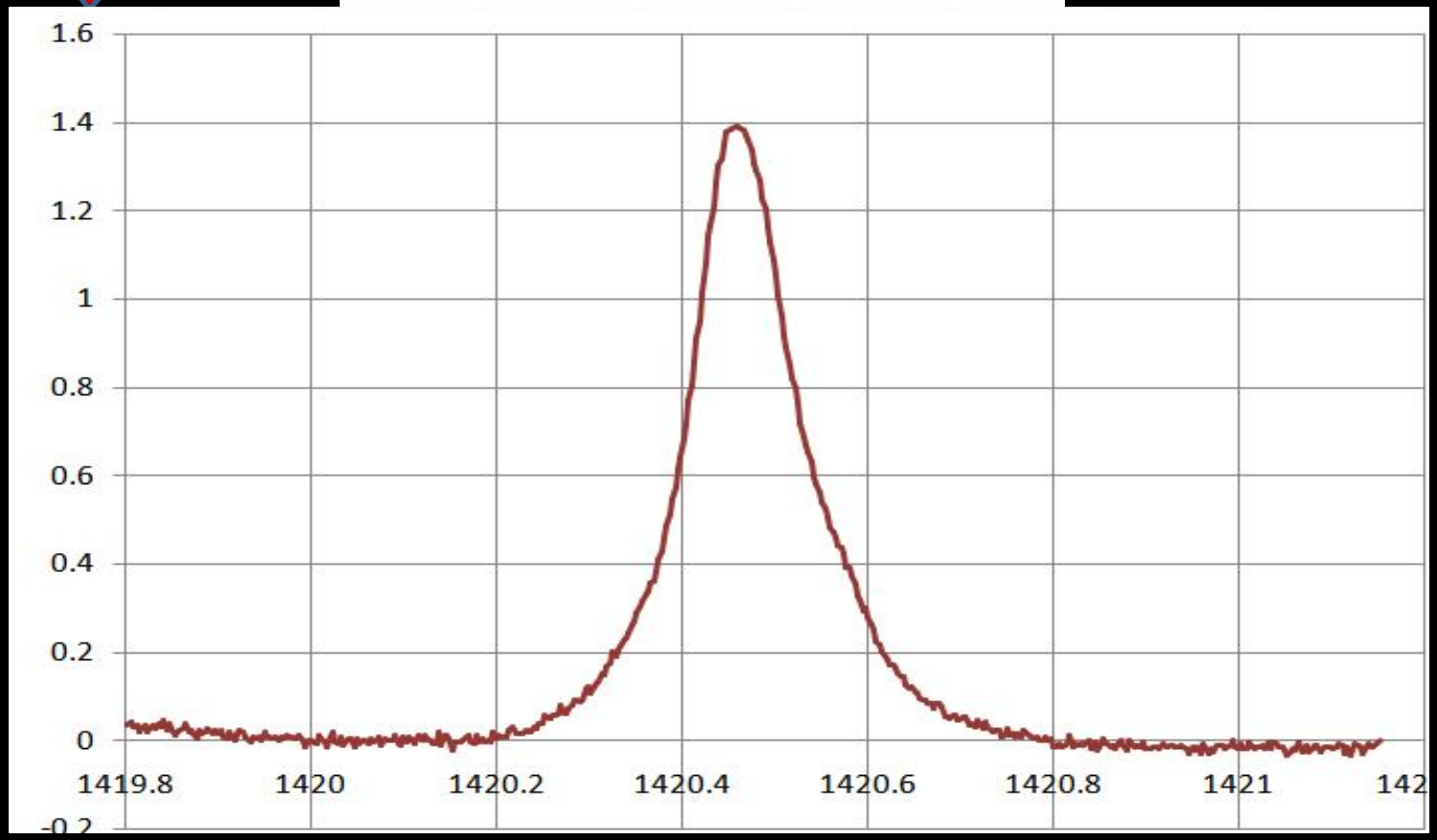
	A	B	C	D
1	1419.655	0.000056419	-0.00149	84.97
2	1419.65793	0.000056572	0.022031	
3	1419.660859	0.000056635	0.031698	
4	1419.663789	0.0000568	0.056967	
5	1419.666719	0.00005698	0.084449	
6	1419.669648	0.000057148	0.110021	
7	1419.672578	0.000057293	0.132031	
8	1419.675508	0.000057461	0.157464	
9	1419.678438	0.000057631	0.183123	
10	1419.681367	0.000057803	0.209008	
11	1419.684297	0.000057875	0.21982	
12	1419.687227	0.000057908	0.224771	



Hydrogen 21-cm wavelength RF Emission Spectrum

dB Relative to Background Noise

dB = 20* log10(data) + OFFSET



Frequency MHz

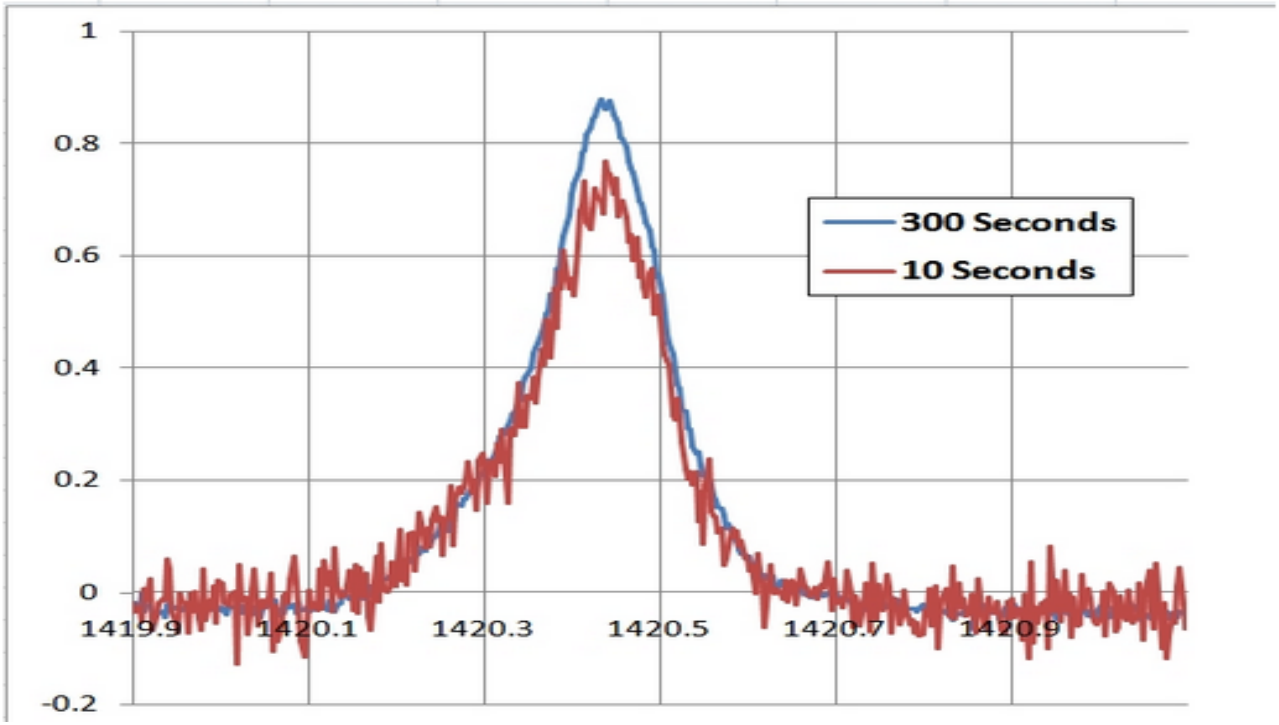
I captured a comparison between **10 second and 300 averages.**

Wolfgang recommends sampling at ~ **1/10 the beam width** of your antenna .. If that is 12.5 degrees, that equates to 1.25 degrees per sample and that = **300 Seconds.**

Acquiring at 10 secs/frame = 0.042 degrees
= **1/300 the beam width of a 12.5 deg antenna**

You " do not loose **Useful *spatial resolution*** " as much as you gain **Un-Useful *Noise***

Same setup, different sample times



SOFTWARE Links misc info

https://www.rtl-sdr.com/cheap-and-easy-hydrogen-line-radio-astronomy-with-a-rtl-sdr-wifi-parabolic-grid-dish-lna-and-sdrsharp/

https://www.youtube.com/watch?v=C6NCefVxNL8

SARA 2022 Eastern Conference

Galactic Hydrogen 1.42 GHz RF Emission Radio Astronomy for $300 Alex Pettit
SARA www.radio-astronomy.org

The $300 SARA 'Scope in a Box' Radio Telescope System and Beyond
A beginner's introduction into receiving and processing 1.42 GHz RF emission signals from neutral hydrogen regions within the Milky Way Alex Petit

This presentation will briefly overview the history and value of radio astronomy. It will describe the Analog RF and Digital Signal hardware components and the basic software needed to acquire, process, and display the data. Drift Scan data recording will be explained, and several upgrades will be suggested for improvements in signal amplitude and quality.

Radio Astronomy Presentations from the
Society of Amateur Radio Astronomers Eastern Conference July 2022

Introduction to Radio Astronomy

https://www.youtube.com/watch?v=AOgvjRXnins

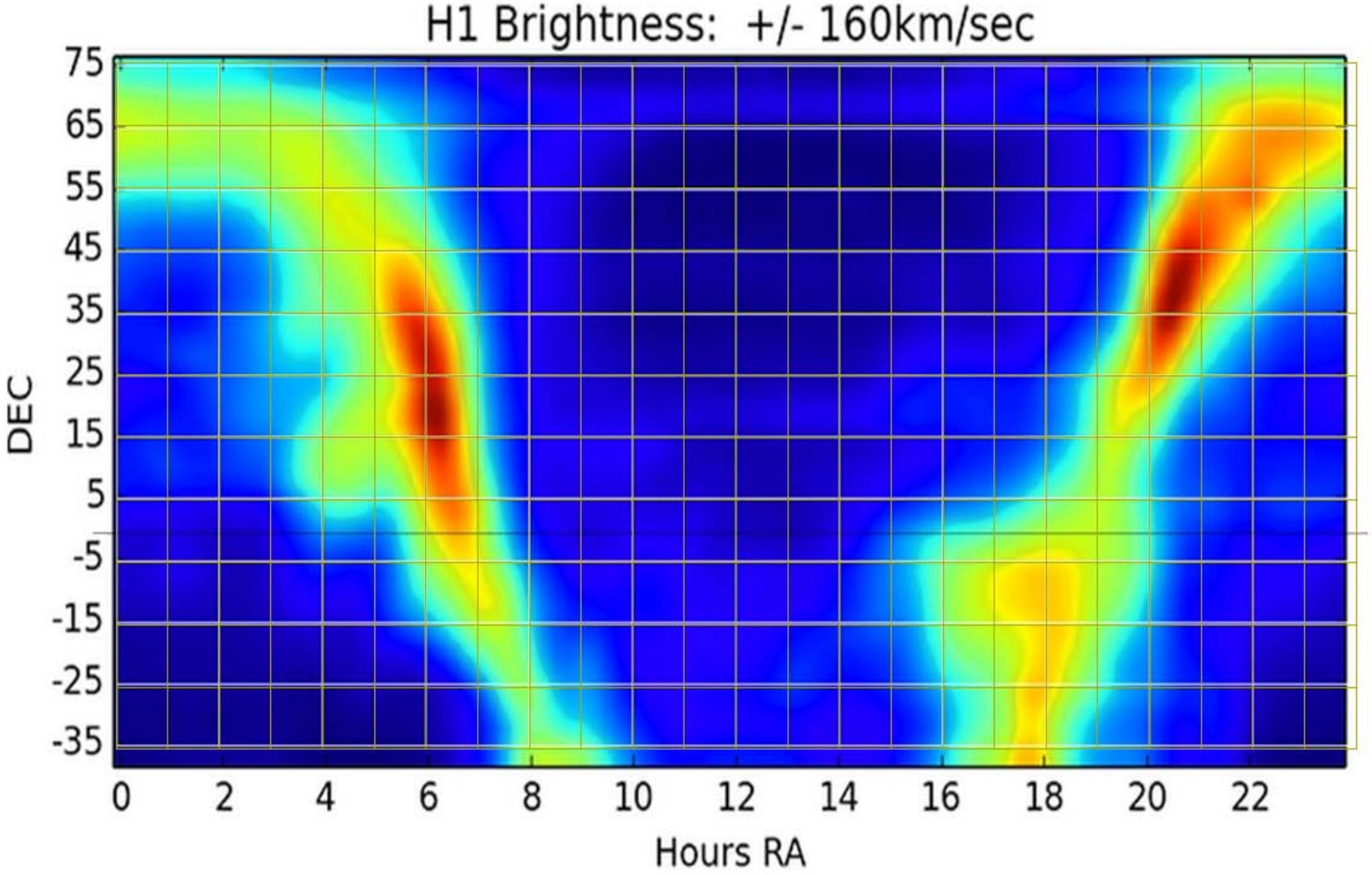
Dr. Wolfgang Herrmann Keynote Amateur Radio Astronomy Possibilities and Limitations,...

https://www.youtube.com/watch?v=8j1bVpC6M94

Alex Pettit: Galactic Hydrogen 1.42 GHz RF Emission Radio Astronomy

https://www.youtube.com/watch?v=C6NCefVxNL8

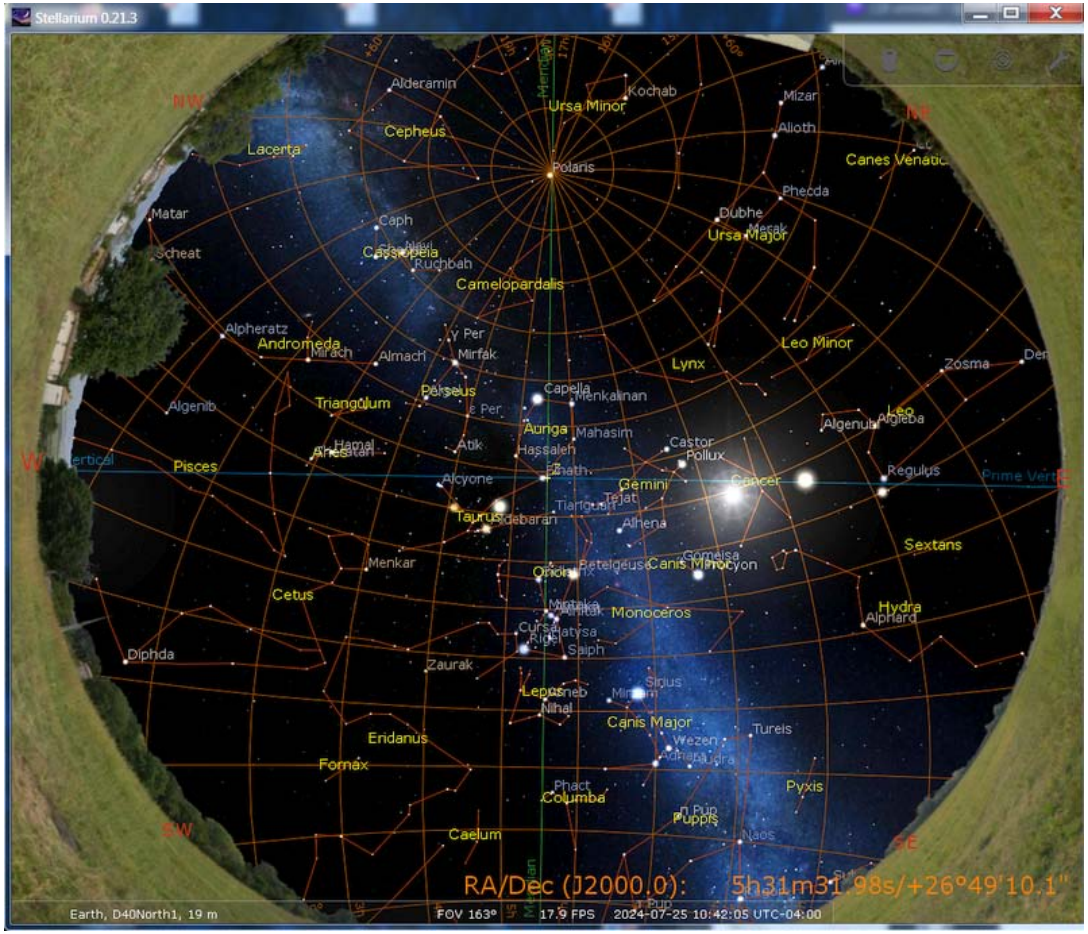
Milky Way 21cm Neutral Hydrogen Line Brightness Intensity Chart

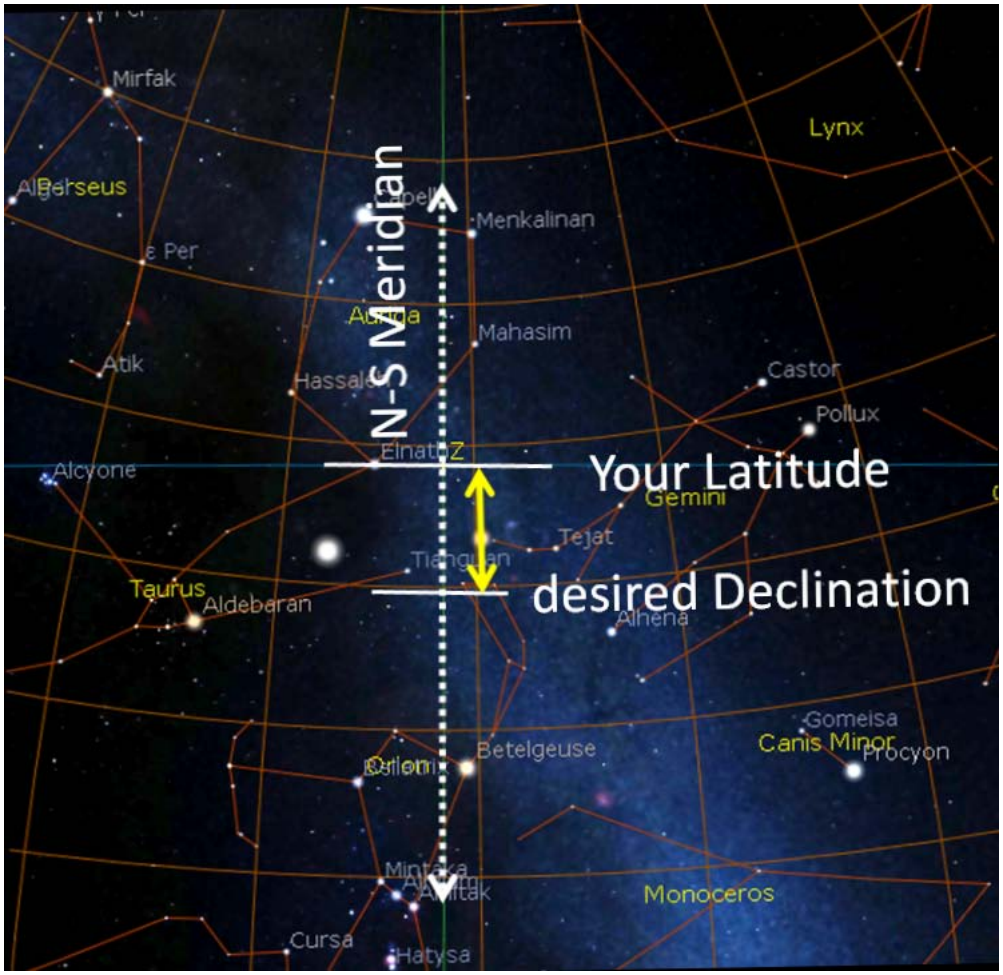


With Permission Marcus Leech CCERA **Canadian Centre Experimental Radio Astronomy**

Stellarium Planetarium Program
find when Milky Way is overhead and RA Time

https://stellarium.org,




N-S Meridian
Your Latitude
desired Declination
Mirfak
Lynx
Menkalinan
ε Per
Mahasim
Atik
Castor
Pollux
Alcyone
Gemini
Tejat
Taurus
Aldebaran
Alhena
Gomeisa
Canis Minor
Procyon
Betelgeuse
Monoceros
Cursa
Hatysa