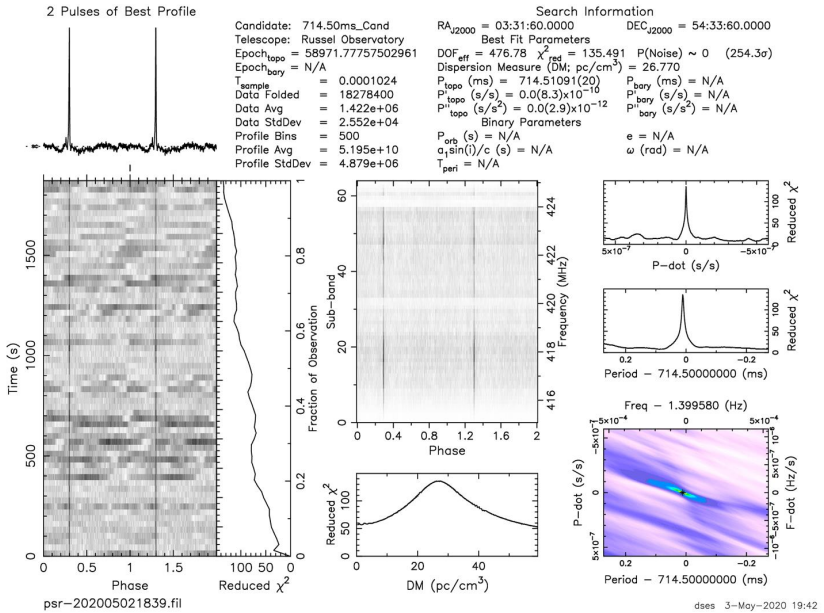
Deep Space Exploration Society Science Meeting



DSES First Pulsar Detection
B0329+54

May 25, 2020

Dr. Richard Russel
DrRichRussel@netscape.net

Information

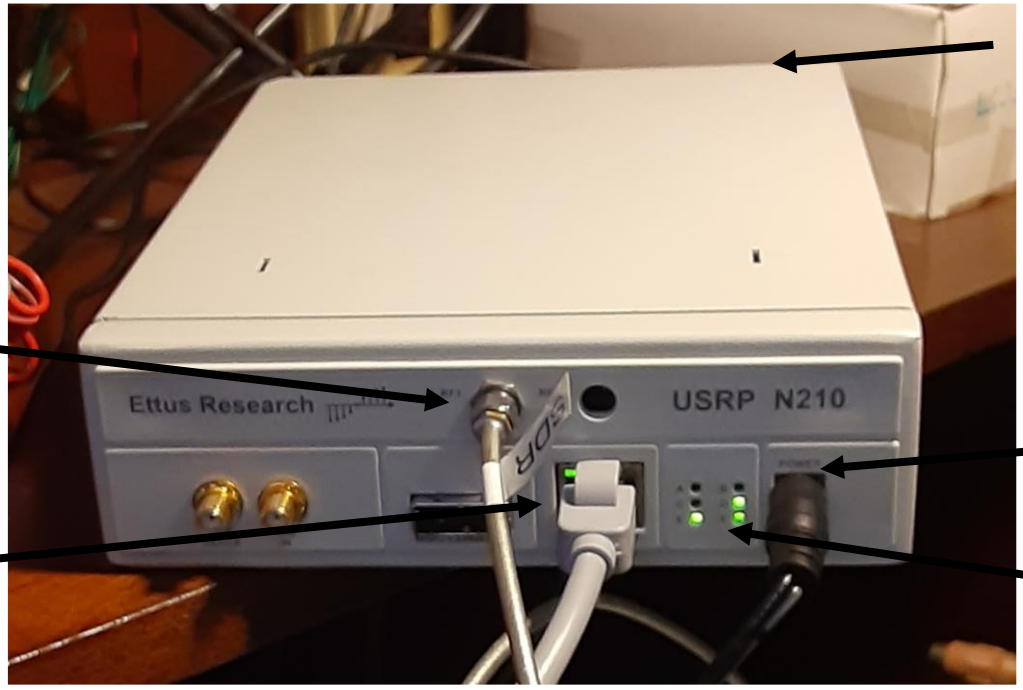
- 9 ft Dish – Down because hard drive crashed
- SuperSID – Down because of hard drive crash
- Radio Jupiter – still need to get a new receiver and setup at site (new member project?)
- Pulsar – Last observation trip Saturday – site power down
- SARA East Conference – recommend everyone virtually attend: August 1-2 www.radio-astronomy.org
- DSES Pulsar featured on Neutron Star Group website http://www.neutronstar.joataman.net/

First DSES Pulsar Observation
May 2, 2020

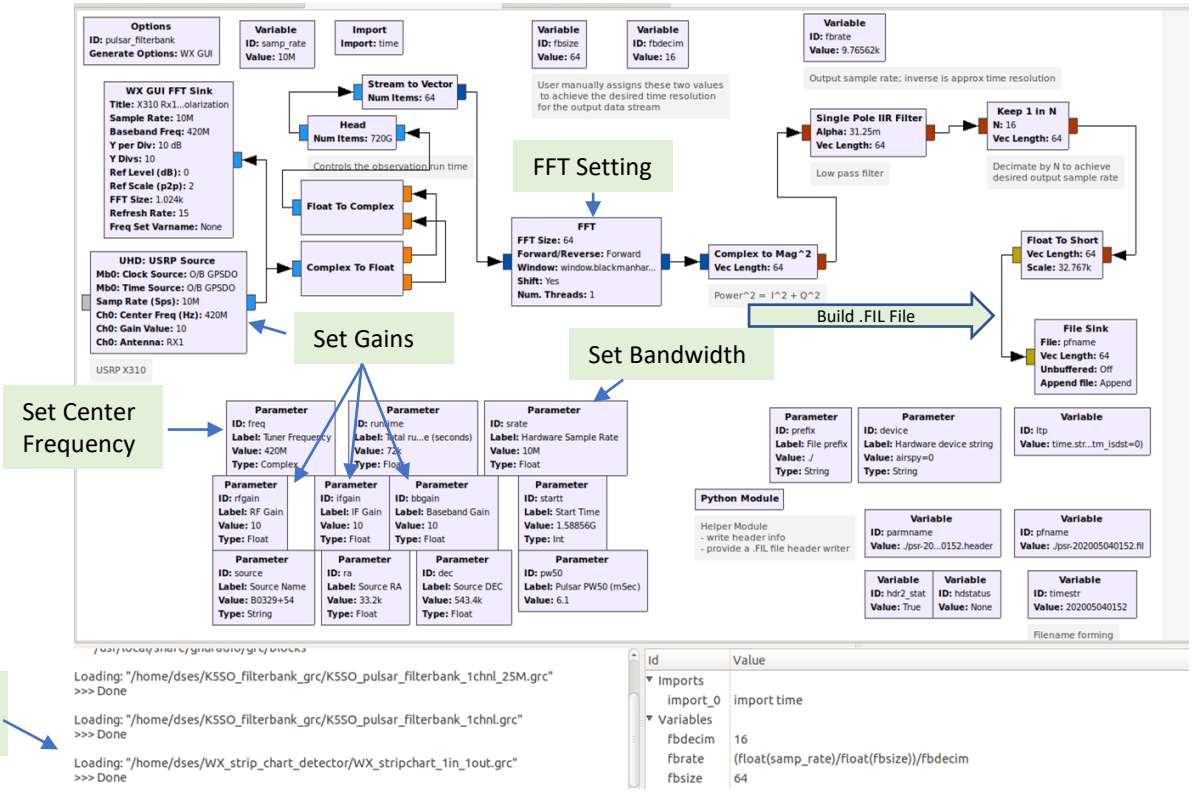
- Pulsar B0329+54
- Observers: Rich Russel, Ray Uberecken, Bob Haggert
- Antenna: 60 ft DSES Dish - Haswell, CO
- DSES Members all contributed to this success!

- Special recognition to Steve Plock for getting the pulsar system started!

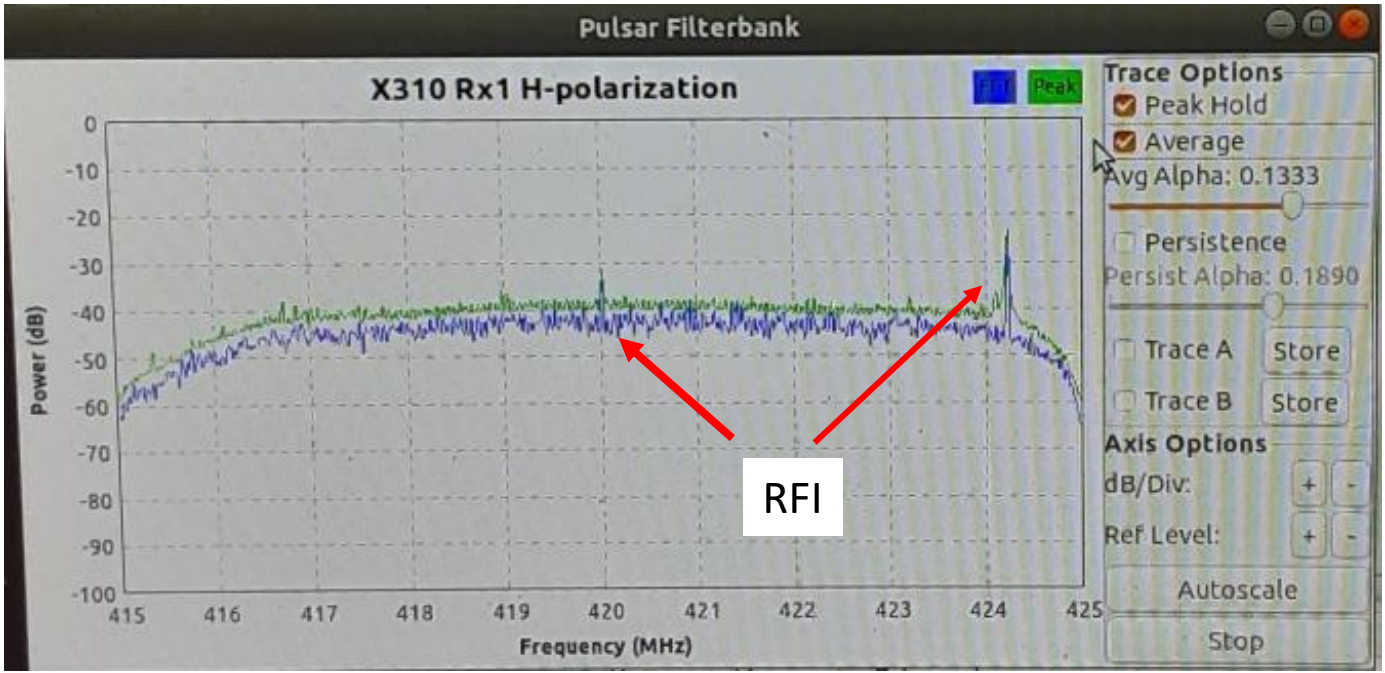
Ettus Research USRP N210 Software Defined Radio



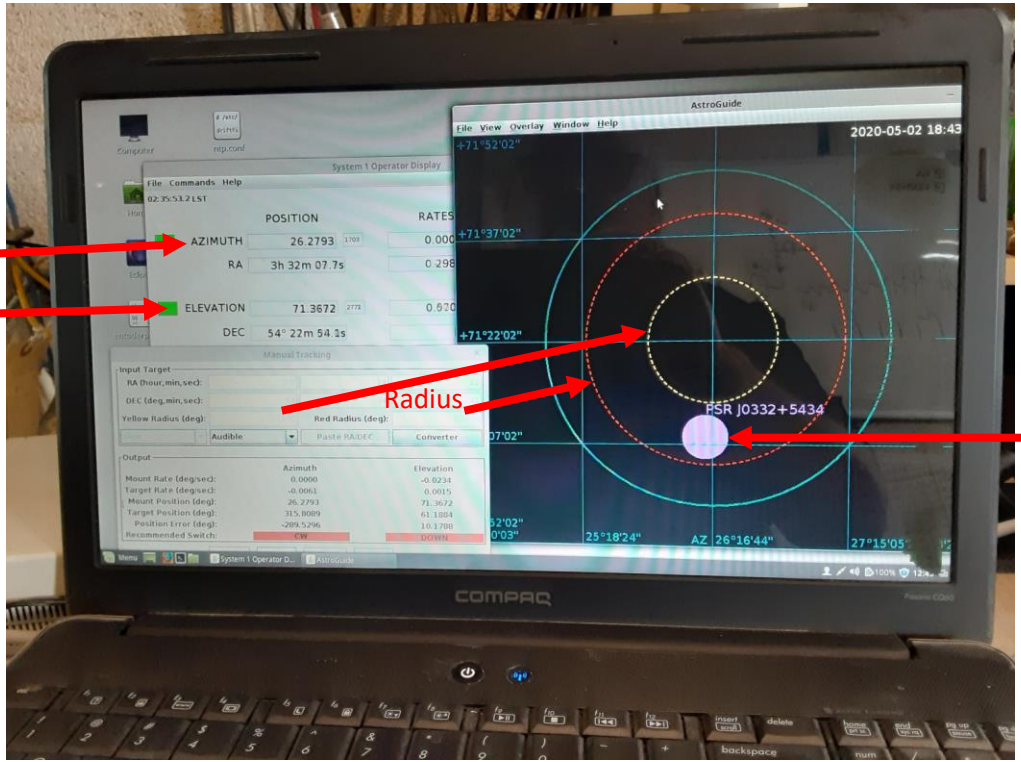
GNU Software developed by Dr. Joe Martin (K5SO)



Spectrum Plot During Observation

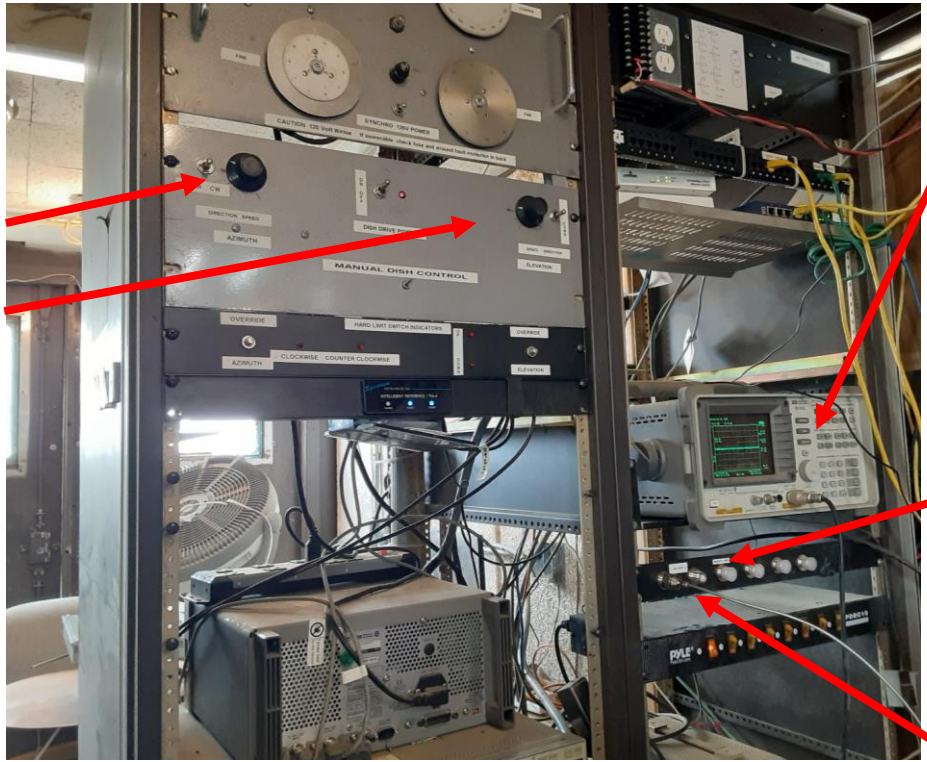


System 1 Pointing Software



Trailer Setup

Rack Equipment



Azimuth Control

Elevation Control

Spectrum Analyzer
-use to check for RFI

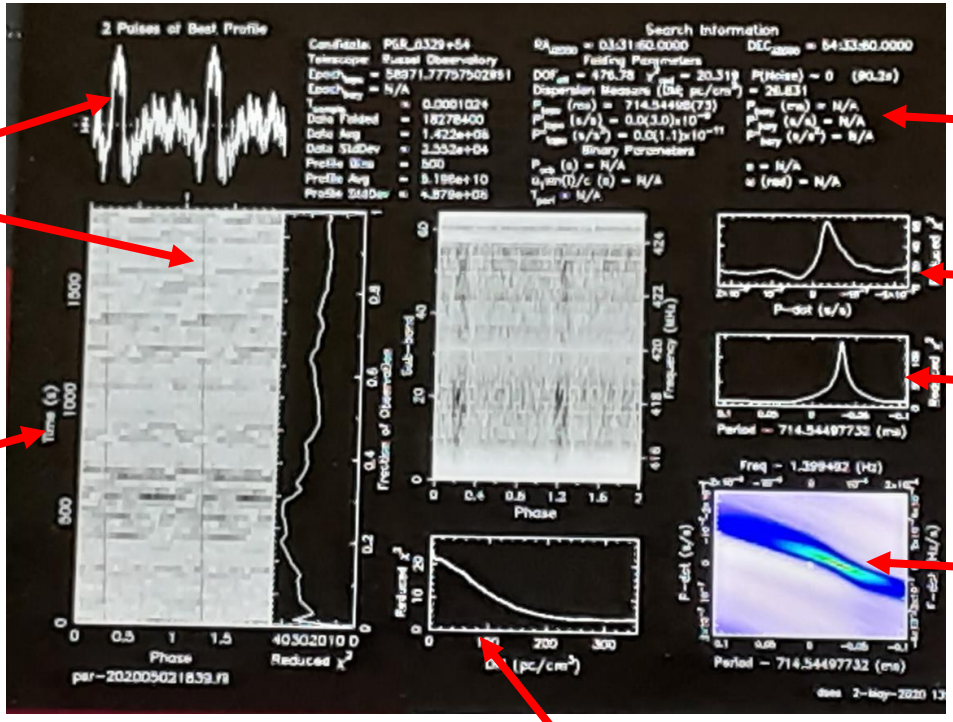
Required to set center frequency and bandwidth

Preamp Power Switch

20 dB Preamp (behind)

RF Output from antenna system

B0329+54 Initial Processed .FIL File Pulses too wide – (wrong period input)



Single and Duplicate pulse

Acquisition Time

Calculated Parameters

Pdot

Period

Period/Pdot Plot

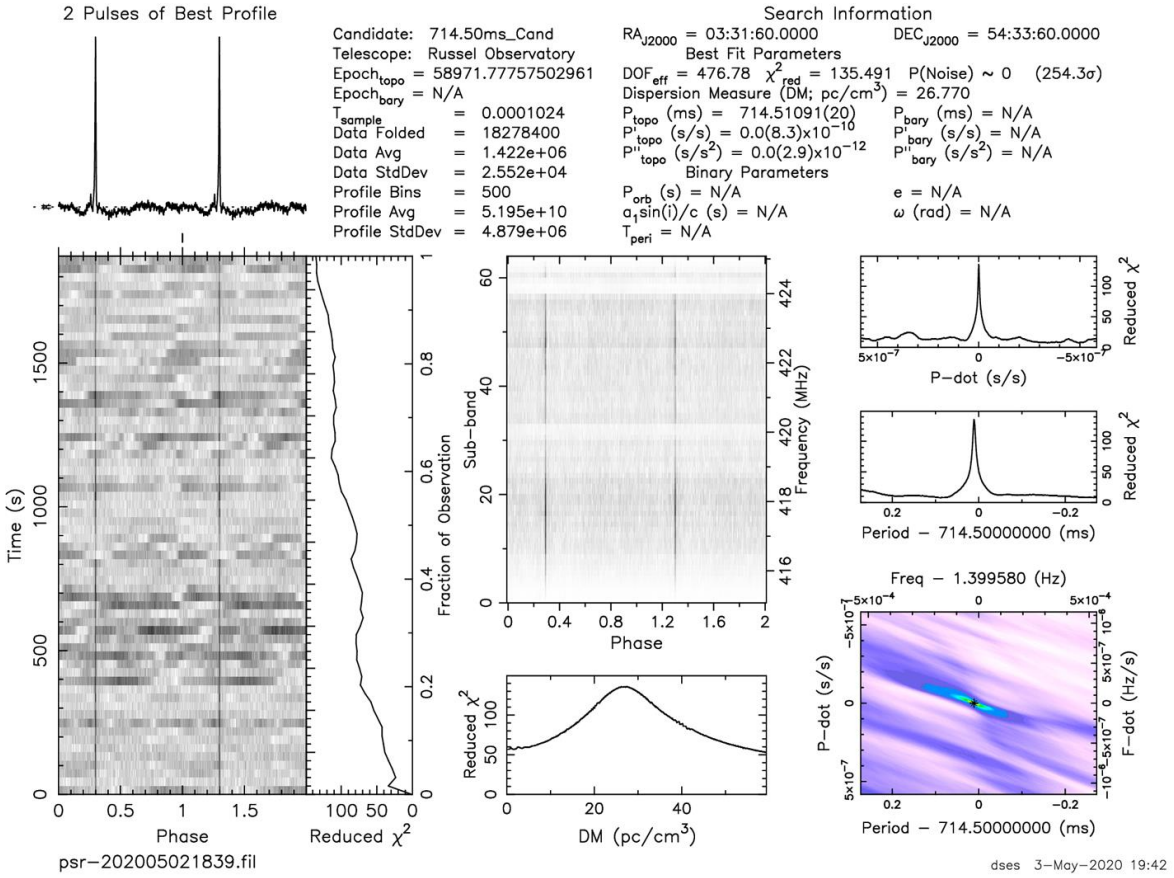
Goal is to center dot

Dispersion Measure

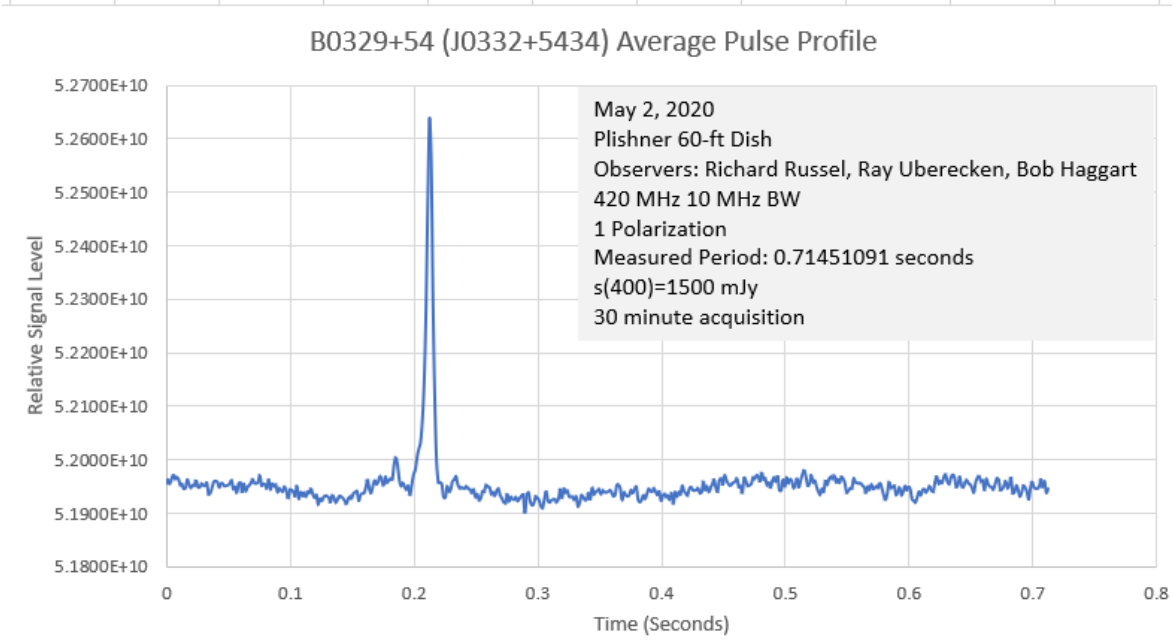
PRESTO Software Homepage: http://www.cv.nrao.edu/~sransom/presto/

- PRESTO is freely available from github https://github.com/scottransom/presto

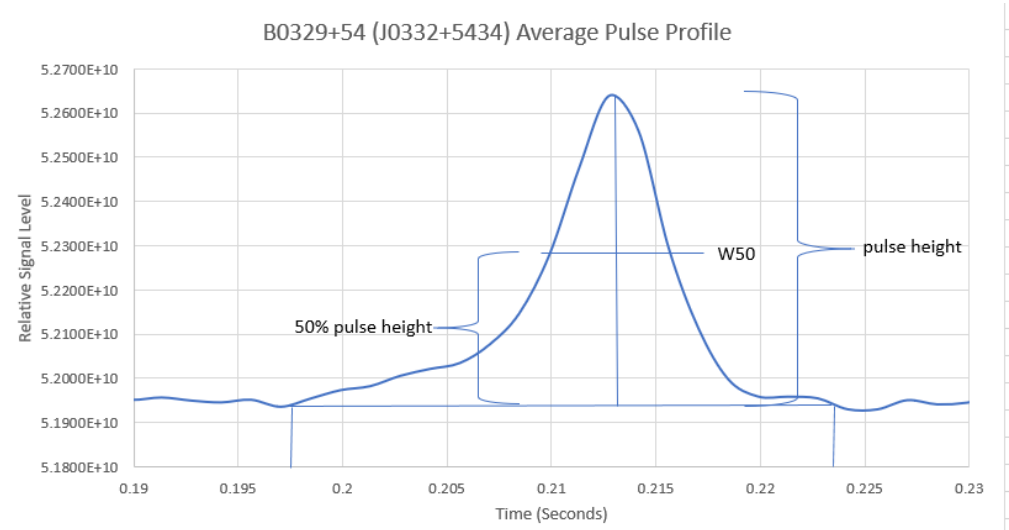
B0329+54
Processed .FIL File after Multiple Iterations of Period



Data Output Plotted in Excel



Analyzing Data to Determine W(50)



Pulse Width (100%)	0.027 seconds	
Pulse Height	0.0708	
50% Pulse Height	5.2284	
Pulse Width 50% (W50)	0.006 seconds	6 ms
ATNF W50	0.0066 seconds	6.6 ms

W(50) is 50% of pulse height
Expected value for B0329+54 is 6.6 ms

Value measured is approx. 6.0 ms

Better data analysis can help improve accuracy

Murmur Pulsar Planning

Enter Antenna Location

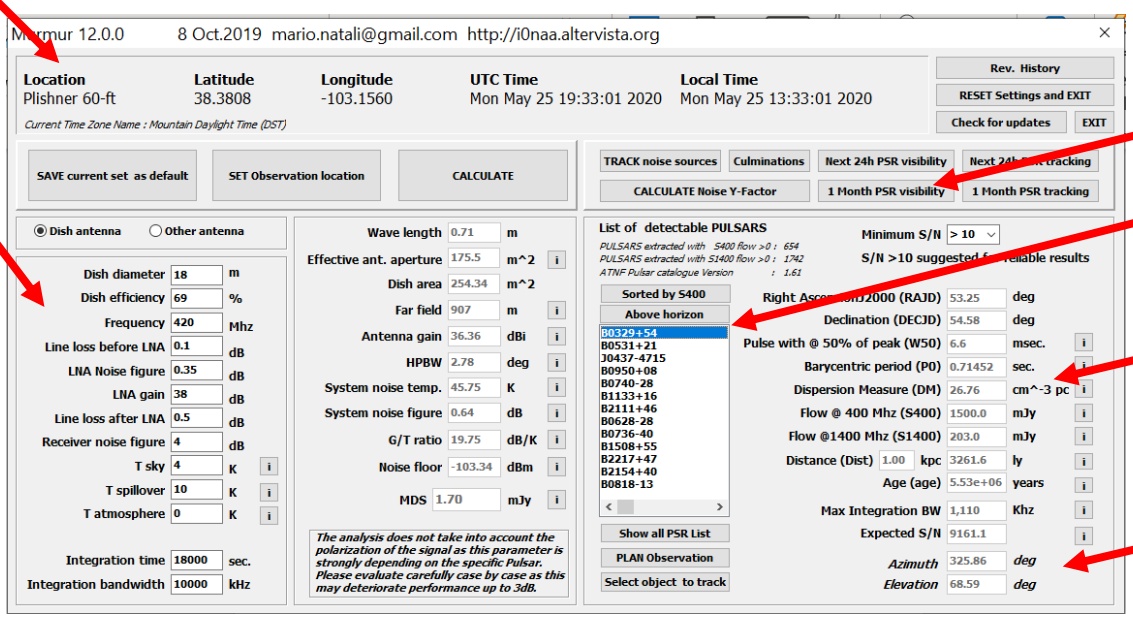
Antenna Calculations

Observation Planning

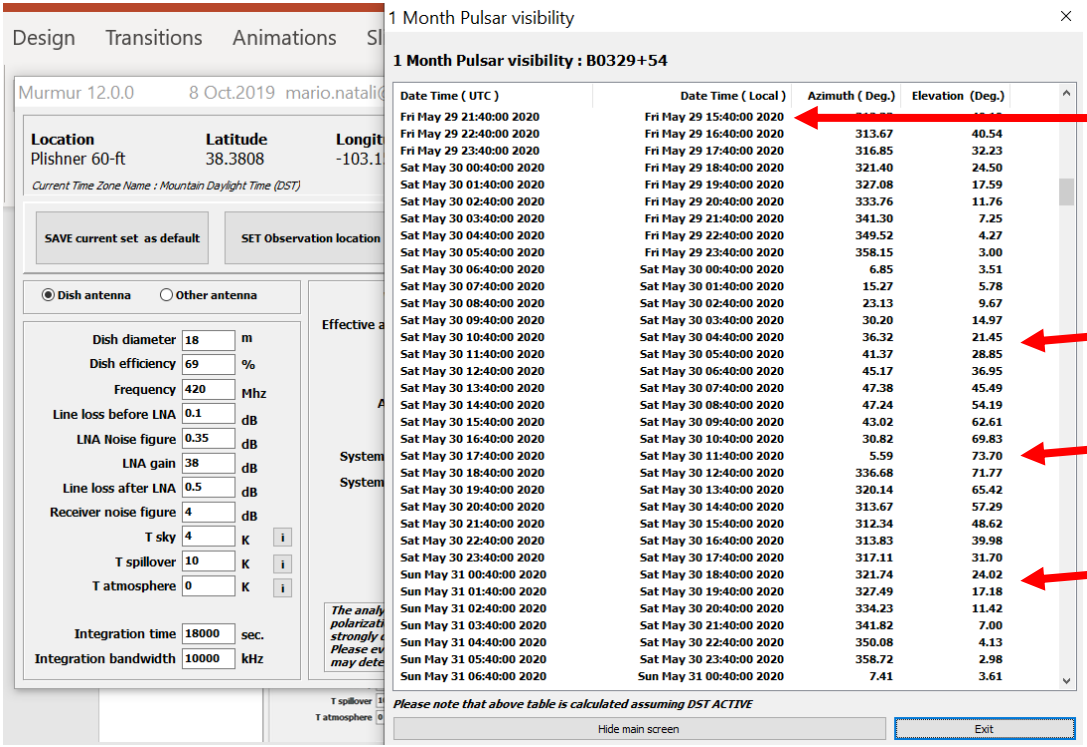
Pulsar Selection

Pulsar Parameters

Current Pulsar AZ/EL



Murmur 1 Month Schedule (B0329+54)



Local Date/Time

Elevation Rise > 20 deg

Max Elevation

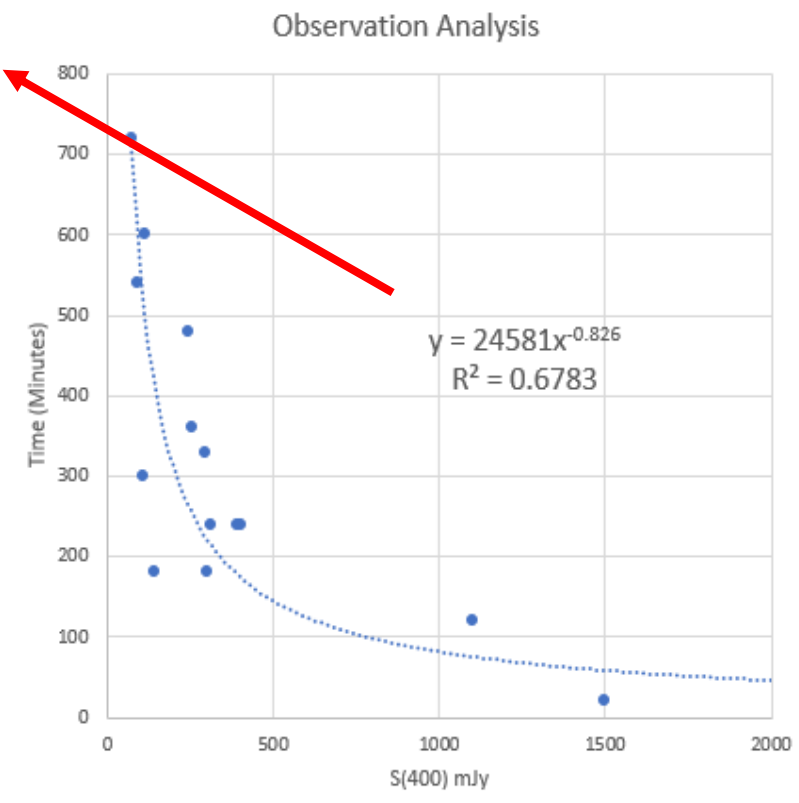
Set < 20 deg

Pulsar Observation Log

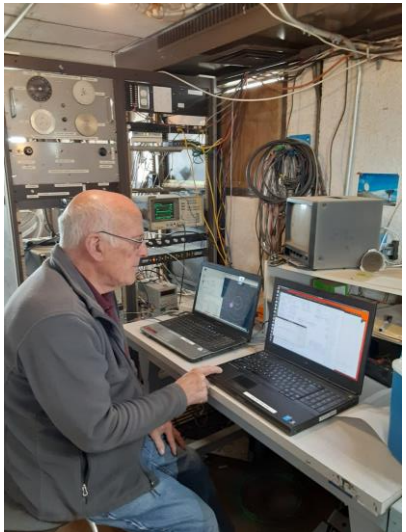
Pulsar BNAME	S400 (mJy)	Max Elevation	Local Time	Date	K5SO Obs Time (Min)	Calc Obs Time(min)	Date Observed	Period (s)	DM	W50 (ms)	RA (Deg)	RA (Hr)	DEC (Deg)	Start Time	End Time	Delta Time (hr:min)	File Name (.FIL)	Success (Y/N)
B1641-45	375	6	1:20	5/30/2020		184		0.45508	478.8	8.0	251.21	16.75	-45.99	0:00	0:00	0:00		
B1642-03	393	48	1:25	5/30/2020	240	177		0.38769	35.76	3.4	251.26	16.75	-3.3	0:00	0:00	0:00		
B1749-28	1100	23	2:46	5/30/2020	120	76		0.56256	50.37	6.1	268.24	17.88	-28.11	0:00	0:00	0:00		
B1929+10	303	62	3:30	5/30/2020	180	219		0.22652	3.18	5.7	293.06	19.54	10.99	0:00	0:00	0:00		
B1933+16	242	67	3:32	5/30/2020	480	264		0.35874	158.52	6.0	293.95	19.6	16.28	0:00	0:00	0:00		
B2016+28	314	80	4:35	5/30/2020	240	213		0.55795	14.2	14.9	304.52	20.3	28.67	0:00	0:00	0:00		
B2111+46	141	81	5:36	5/30/2020	180	412		1.01469	141.26	32.1	318.35	21.22	46.74	0:00	0:00	0:00		
B2154+40	105	85	6:40	5/30/2020	300	526		1.52527	71.12	38.6	329.26	21.95	40.3	0:00	0:00	0:00		
B2217+47	111	80	6:42	5/30/2020		503		0.53847	43.5	7.5	334.95	22.33	47.51	0:00	0:00	0:00		
B0329+54	1500		11:40	5/9/2020	20	58	5/9/2020	0.71452	26.7641	6.6	53.25	3.55	54.58	15:58	16:28	0:30	PSR-202005091558	Y
B0329+54	1500	73	11:40	5/30/2020		58	5/9/2020	0.71452	26.7641	6.6	53.25	3.55	54.58	0:00	0:00	0:00		
J0437-4715	550	4	12:44	5/30/2020		134		0.00576	2.64	0.1	69.32	4.62	-47.25	0:00	0:00	0:00		
B0531+21	550	73	13:41	5/9/2020		134	5/9/2020	0.03339	56.7712	3.0	83.63	5.58	22.01	18:28	19:28	1:00	PSR-202005091827	N
B0531+21	550	73	13:41	5/30/2020		134		0.03339	56.7712	3.0	83.63	5.58	22.01	0:00	0:00	0:00		
B0628-28	206	23	15:09	5/30/2020		302		1.24442	34.42	63.3	97.71	6.51	-28.58	0:00	0:00	0:00		
B0736-40	190	11	16:10	5/30/2020		322		0.37492	160.9	22.7	114.63	7.64	-40.71	0:00	0:00	0:00		
B0740-28	296	23	16:12	5/30/2020	330	224		0.16676	73.73	4.2	115.7	7.71	-28.38	0:00	0:00	0:00		
B0823+26	73	78	16:33	5/9/2020	720	710	5/9/2020	0.5366	19.4763	5.8	126.71	8.45	26.62	17:07	18:07	1:00	PSR-202005091706	N
B0823+26	73	78	16:33	5/30/2020		710		0.5366	19.4763	5.8	126.71	8.45	26.62	0:00	0:00	0:00		
B0835-41	197	10	16:36	5/30/2020		313		0.75162	147.29	4.4	129.34	8.62	-41.59	0:00	0:00	0:00		
B0818-13	102	37	17:13	5/30/2020		539		1.23813	40.94	21.7	125.11	8.34	-13.85	0:00	0:00	0:00		
B0833-45	5000	6	17:15	5/30/2020		22		0.08933	67.97	1.4	128.84	8.59	-45.18	0:00	0:00	0:00		
B0834+06	89	57	17:22	5/30/2020	540	603		1.27377	12.86	24.8	129.27	8.62	6.17	0:00	0:00	0:00		
B0950+08	400	59	18:39	5/9/2020	240	174	5/9/2020	0.25306	2.97	8.9	148.29	9.89	7.93	19:47	21:17	1:30	PSR-202005091947	N
B0950+08	400	59	18:39	5/30/2020		174		0.25306	2.97	8.9	148.29	9.89	7.93	0:00	0:00	0:00		
B1133+16	257	67	20:17	5/30/2020	360	251		1.18791	4.84	5.9	174.01	11.6	15.85	0:00	0:00	0:00		
B1508+55	114	72	23:19	5/30/2020	600	492		0.73968	19.62	10.9	227.36	15.16	55.53	0:00	0:00	0:00		

Use Historic Observation Times to estimate the formula for predicted observing time based on S(400) Level

Pulsar BNAME	S400 (mJy)	Max Elevation	Local Time	Date	K55O Obs Time (Min)	Calc Obs Time(min)
B1641-45	375	6	1:20	5/30/2020		184
B1642-03	393	48	1:25	5/30/2020	240	177
B1749-28	1100	23	2:46	5/30/2020	120	76
B1929+10	303	62	3:30	5/30/2020	180	219
B1933+16	242	67	3:32	5/30/2020	480	264
B2016+28	314	80	4:35	5/30/2020	240	213
B2111+46	141	81	5:36	5/30/2020	180	412
B2154+40	105	85	6:40	5/30/2020	300	526
B2217+47	111	80	6:42	5/30/2020		503
B0329+54	1500		11:40	5/9/2020	20	58
B0329+54	1500	73	11:40	5/30/2020		58
J0437-4715	550	4	12:44	5/30/2020		134
B0531+21	550	73	13:41	5/9/2020		134
B0531+21	550	73	13:41	5/30/2020		134
B0628-28	206	23	15:09	5/30/2020		302
B0736-40	190	11	16:10	5/30/2020		322
B0740-28	296	23	16:12	5/30/2020	330	224
B0823+26	73	78	16:33	5/9/2020	720	710
B0823+26	73	78	16:33	5/30/2020		710
B0835-41	197	10	16:36	5/30/2020		313
B0818-13	102	37	17:13	5/30/2020		539
B0833-45	5000	6	17:15	5/30/2020		22
B0834+06	89	57	17:22	5/30/2020	540	603
B0950+08	400	59	18:39	5/9/2020	240	174
B0950+08	400	59	18:39	5/30/2020		174
B1133+16	257	67	20:17	5/30/2020	360	251
B1508+55	114	72	23:19	5/30/2020	600	492



Pulsar Observing Trip Pics



Questions?