



# Murmur Visual-Manual

***IONAA***

**[mario.natali@gmail.com](mailto:mario.natali@gmail.com)**

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# Murmur

## *General information*

- ✓ **Murmur is developed with Embarcadero® C++Builder 10.2 ( community edition ) and Epina GmbH SDL Component Suite.**
- ✓ **Murmur is distributed with «Inno Setup» Windows installer.**
- ✓ **Starting from version 9.0.0 the installation process creates a main folder C:\Murmur and a subfolder named C:\Murmur\Murmur .**
- ✓ **The program uses the subfolder to store all the support files ( .txt and .csv ) and the ATNF.csv that stores the list and main Pulsars parameters obtained from ATNF catalogue.**
- ✓ **To fully remove the program from the PC please run the uninstaller and remove manually the folders.**
- ✓ **The program was scanned with latest Kaspersky anti-virus system ( at the time of the publication ) before publishing.**
- ✓ **Added, in the download page of the web site, the zipped file checksum information to guarantee original package integrity.**



# Murmur

## Revision history

### Revision History

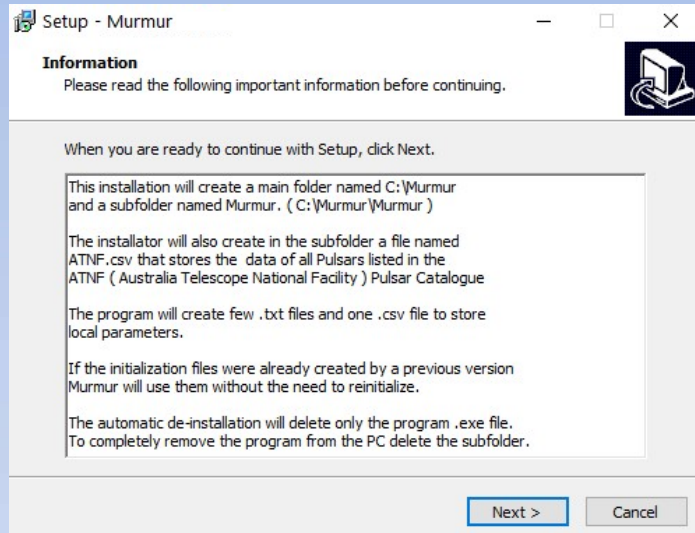
Date	Change
5 November 2024	Release 18.3.0
5 November 2024	Updated ATNF Catalogue ( ATNF.csv ) to Rev. 2.5.1
5 November 2024	Corrected a bug in <Select object to track> function . Thanks Keith GOJLO for highlighting the problem
5 November 2024	Release 18.2.0
26 September 2024	Updated ATNF Catalogue ( ATNF.csv ) to Rev. 2.4.0
26 September 2024	Corrected a bug that masked up to 11 pulsars from the detection analysis. Thanks Keith GOJLO for highlighting the problem
28 March 2024	Release 18.1.0
28 March 2024	Updated ATNF Catalogue ( ATNF.csv ) to Rev. 2.1.1
28 March 2024	Corrected bug in Sun Flux calculations that was showing incorrect SFU when value was above 1000000 Jy.
20 February 2024	Release 18.0.0
20 February 2024	Updated ATNF Catalogue ( ATNF.csv ) to Rev. 2.0.0
20 February 2024	Updated routine to read ATNF version number to align with new ATNF nomenclature.
20 February 2024	Corrected a bug in <CALCULATE Noise Y-Factor> that was generating error when Murmur was not installed in the root directory. Thanks to Roger W3SZ for addressing the problem and helping in debug.
20 February 2024	Corrected a bug in <CALCULATE Noise Y-Factor> that was generating an error when trying to delete a row in the database without specifying row number. Thanks to Roger W3SZ for addressing the problem and helping in debug.
15 June 2023	Release 17.3.0
15 June 2023	Updated ATNF Catalogue ( ATNF.csv ) to Rev. 1.70
15 June 2023	Added SGR 1935+2154 Fast Radio Burst-emitting Magnetar to <Noise Source tracking> widget. This Magnetar is not reported in MURMUR internal data base as no S400 and S1400 were published. To find detailed parameters please access ATNF catalogue at <a href="https://www.atnf.csiro.au/research/pulsar/psrcat/">https://www.atnf.csiro.au/research/pulsar/psrcat/</a>
22 October 2022	Release 17.2.0
22 October 2022	Updated ATNF Catalogue ( ATNF.csv ) to Rev. 1.68
22 October 2022	Added FRB 20220912A and removed Magnetar J1809-1943. Thanks to Keith GOJLO for help in checking RA and DEC.
24 May 2022	Release 17.1.0
24 May 2022	Added ( in the the web site ) the Checksum information for the zipped package in order to help checking original package integrity
24 May 2022	Corrected bug that was generating wrong Az for FRB in <Plan observation> mode. Thanks to Keith GOJLO for help in debugging



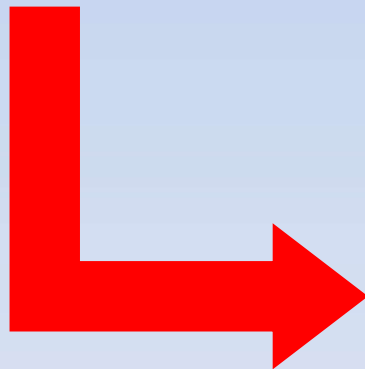
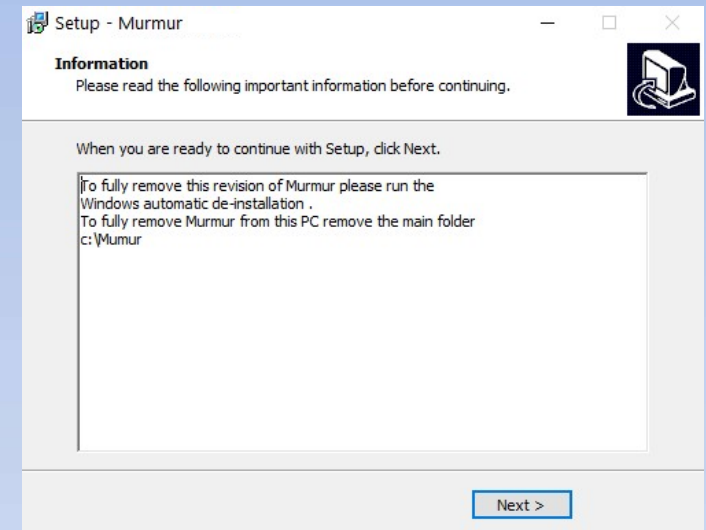
# Murmur

## Installation

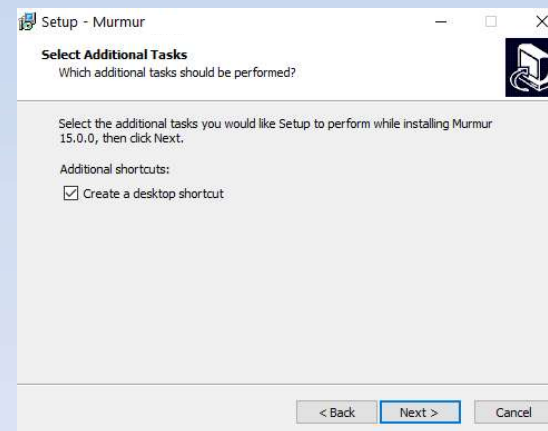
**The first screen informs that the installation process will create the main folder and a subfolder.**



**The last screen explains how to fully remove Murmur from the PC.**



**The next screen asks for permission to create a shortcut to launch Murmur.**





# Murmur

## Initial setup of the program

When «Murmur» is launched for the first time, the program starts in «Pulsar mode» and a message visualizes the list of all support files needed that will be created

**Pulsar mode**

Location Latitude Longitude UTC Time Local Time  
Thu Feb 3 18:54:04 2022

Current Time Zone Name : ora solare Europa occidentale (Not DST)

System evaluation mode SAVE current set as default CALCULATE  
Pulsar mode SET Observation location

TRACK noise sources Culminations Next 24h PSR visibility Next 24h PSR tracking  
CALCULATE Noise Y-Factor 1 Month PSR visibility 1 Month PSR tracking

Dish antenna  Other antenna

Wave length m  
Effective ant. aperture m<sup>2</sup>  
Dish area m<sup>2</sup>  
Far field m  
Antenna gain dBi  
HPBW deg  
System noise temp. K  
System noise figure dB  
G/T ratio dB/K  
Noise floor dBm  
MDS mJy

List of detectable PULSARS  
Minimum S/N > 10  
S/N > 10 suggested for reliable results

Sorted by S/N  
Above horizon

Right Ascension(J2000 (RAJD) deg  
Declination (DECJD) deg  
Pulse with @ 50% of peak (W50) msec.  
Barycentric period (P0) sec.  
Dispersion Measure (DM) cm<sup>-3</sup> pc  
Flux @ 400 Mhz (S400) mJy  
Flux @1400 Mhz (S1400) mJy  
Distance (Dist) kpc ly  
Age (age) years  
Max Int. BW (no de-dispersion) kHz  
Expected S/N

Azimuth deg  
Elevation deg

Show all PSR List  
PLAIN Observation  
Select object to track

*The analysis does not take into account the polarization of the signal as this parameter is strongly depending on the specific Pulsar. Please evaluate carefully case by case as this may deteriorate performance up to 3db.*

Please note that following files will be created in the installation folder to store the configuration, the history and the Pulsar Data Base:

MurmurDB.txt	Local configuration
SunFlowNoaa.txt	Most recent sun flow data from NOAA
NoiseMeasurements.txt	Noise measurements data
ddmmyy.csv	Archive of noise measurements
Murmur_horizon.txt	Radio horizon configuration
ATNF.csv	Pulsar Data Base
Release.txt(temp. only)	Check for latest program release
Murmur_captured.txt	Pulsars detected with comments

OK

In case that the file ATNF.csv will not be available the program will stop showing the message reported on the right. To fix this problem you can download again Murmur as the installer includes this file or you can create yourself the file as described at the end of this visual-manual.

ERROR : The file ATNF.csv with Pulsars data was not found.

Please download again Murmur from <http://i0naa.altervista.org>  
The file ATNF.csv is included in the installer.

Note that ATNF.csv can also be created and edited following the instructions in the manual.

OK



# Murmur

## Initial setup of the program

The first thing to define is the type of the antenna .

The program allows to enter «dish antenna» or «other antenna». In the case of «dish antenna» the program will calculate automatically the gain based on the dish diameter, while entering « other antenna» you will need to enter the antenna gain.

**Pulsar mode**

Location: \_\_\_\_\_ Latitude: \_\_\_\_\_ Longitude: \_\_\_\_\_ UTC Time: \_\_\_\_\_ Local Time: Thu Feb 3 19:00:22 2022

Current Time Zone Name : ora solare Europa occidentale (Not DST)

System evaluation mode: [ ] SAVE current set as default: [ ] CALCULATE: [ ]

Pulsar mode: [ ] SET Observation location: [ ]

Dish antenna  Other antenna

Dish diameter: 5 m

Dish efficiency: 69 %

Frequency: 1303 Mhz

Line loss before LNA: 0.1 dB

LNA Noise figure: 0.23 dB

LNA gain: 38 dB

Line loss after LNA: 0.5 dB

Receiver noise figure: 4 dB

T sky: 4 K

T spillover: 10 K

Integration time: 18000 sec.

Integration bandwidth: 10000 kHz

Wave length: \_\_\_\_\_ m

Effective ant. aperture: \_\_\_\_\_ m<sup>2</sup>

Dish area: \_\_\_\_\_ m<sup>2</sup>

Far field: \_\_\_\_\_ m

Antenna gain: \_\_\_\_\_ dBi

HPBW: \_\_\_\_\_ deg

System noise temp.: \_\_\_\_\_ K

System noise figure: \_\_\_\_\_ dB

G/T ratio: \_\_\_\_\_ dB/K

Noise floor: \_\_\_\_\_ dBm

MDS: \_\_\_\_\_ mJy

*The analysis does not take into account the polarization of the signal as this parameter is strongly depending on the specific Pulsar. Please evaluate carefully case by case as this may deteriorate performance up to 3dB.*

List of detectable PULSARS

Minimum S/N > 10

S/N >10 suggested for reliable results

Sorted by S/N

Above horizon

Show all PSR List

PLAN Observation

Select object to track

**Pulsar mode**

Location: \_\_\_\_\_ Latitude: \_\_\_\_\_ Longitude: \_\_\_\_\_ UTC Time: \_\_\_\_\_ Local Time: Thu Feb 3 19:02:47 2022

Current Time Zone Name : ora solare Europa occidentale (Not DST)

System evaluation mode: [ ] SAVE current set as default: [ ] CALCULATE: [ ]

Pulsar mode: [ ] SET Observation location: [ ]

Dish antenna  Other antenna

Antenna gain: 30.00 dBi

Frequency: 1303 Mhz

Line loss before LNA: 0.1 dB

LNA Noise figure: 0.23 dB

LNA gain: 38 dB

Line loss after LNA: 0.5 dB

Receiver noise figure: 4 dB

T sky: 4 K

T spillover: 10 K

Integration time: 18000 sec.

Integration bandwidth: 10000 kHz

Wave length: \_\_\_\_\_ m

Effective ant. aperture: \_\_\_\_\_ m<sup>2</sup>

System noise temp.: \_\_\_\_\_ K

System noise figure: \_\_\_\_\_ dB

G/T ratio: \_\_\_\_\_ dB/K

Noise floor: \_\_\_\_\_ dBm

MDS: \_\_\_\_\_ mJy

*The analysis does not take into account the polarization of the signal as this parameter is strongly depending on the specific Pulsar. Please evaluate carefully case by case as this may deteriorate performance up to 3dB.*

List of detectable PULSARS

Minimum S/N > 10

S/N >10 suggested for reliable results

Sorted by S/N

Above horizon

Show all PSR List

PLAN Observation

Select object to track

Right Ascension J2000 (RAJD): \_\_\_\_\_ deg

Declination (DECJD): \_\_\_\_\_ deg

Pulse width @ 50% of peak (W50): \_\_\_\_\_ msec.

Barycentric period (P0): \_\_\_\_\_ sec.

Dispersion Measure (DM): \_\_\_\_\_ cm<sup>-3</sup> pc

Flux @ 400 Mhz (S400): \_\_\_\_\_ mJy

Flux @ 1400 Mhz (S1400): \_\_\_\_\_ mJy

Distance (Dist): \_\_\_\_\_ kpc

Age (age): \_\_\_\_\_ years

Max Int. BW (no de-dispersion): \_\_\_\_\_ kHz

Expected S/N: \_\_\_\_\_

Azimuth: \_\_\_\_\_ deg

Elevation: \_\_\_\_\_ deg



# Murmur

## Initial setup of the program

By clicking on «dish antenna» the program will load some default parameter that you can modify to reflect your specific station.

1. Enter Dish diameter in meters.
2. You can modify dish efficiency, reasonable numbers for amateur station runs from 45% to 70%. The higher the better.
3. Enter the frequency at which you want to make the simulation. Please note the only two frequency intervals are available in Pulsar mode : 390Mhz-500Mhz and 1,000Mhz-1,500Mhz.
4. Enter the line loss before LNA ( the preamplifier ). This value is usually very low and 0.1 dB should be ok.
5. Enter the noise figure of your pre-amplifier.
6. Enter the gain of your preamplifier.
7. Enter the loss of the line after the preamplifier. Please note that this value has a very low impact on overall system performance.
8. Enter the receiver Noise Figure. Please note that this value has a very low impact on overall system performance.
9. Enter T Sky. This value is strictly depending on frequency in use. Click **i** button for guidelines.

**Pulsar mode**

Location: \_\_\_\_\_ Latitude: \_\_\_\_\_ Longitude: \_\_\_\_\_ UTC Time: \_\_\_\_\_ Local Time: Thu Feb 3 19:00:22 2022

Current Time Zone Name : ora solare Europa occidentale (Not DST)

System evaluation mode:  Pulsar mode  Other antenna

SAVE current set as default | SET Observation location | CALCULATE

TRACK noise sources | Culminations | Next 24h PSR visibility | Next 24h PSR tracking

CALCULATE Noise Y-Factor | 1 Month PSR visibility | 1 Month PSR tracking

**Dish antenna** (selected) | Other antenna

Dish diameter: 5 m **1**  
Dish efficiency: 69 % **2**  
Frequency: 1303 Mhz **3**  
Line loss before LNA: 0.1 dB **4**  
LNA Noise figure: 0.23 dB **5**  
LNA gain: 38 dB **6**  
Line loss after LNA: 0.5 dB **7**  
Receiver noise figure: 4 dB **8**  
T sky: 4 K **i**  
T spillover: 10 K **9**  
Integration time: 18000 sec. **11**  
Integration bandwidth: 10000 kHz **12**

Wave length: \_\_\_\_\_ m  
Effective ant. aperture: \_\_\_\_\_ m<sup>2</sup> **i**  
Dish area: \_\_\_\_\_ m<sup>2</sup>  
Far field: \_\_\_\_\_ m **i**  
Antenna gain: \_\_\_\_\_ dBi **i**  
HPBW: \_\_\_\_\_ deg **i**  
System noise temp.: \_\_\_\_\_ K **i**  
System noise figure: \_\_\_\_\_ dB **i**  
G/T ratio: \_\_\_\_\_ dB/K **i**  
Noise floor: \_\_\_\_\_ dBm **i**  
MDS: \_\_\_\_\_ mJy **i**

*The analysis does not take into account the polarization of the signal as this parameter is strongly depending on the specific Pulsar. Please evaluate carefully case by case as this may deteriorate performance up to 3dB.*

List of detectable PULSARS | Minimum S/N: > 10 | S/N > 10 suggested for reliable results

Sorted by S/N | Above horizon

Right Ascension(J2000 (RAJD): \_\_\_\_\_ deg  
Declination (DECJD): \_\_\_\_\_ deg  
Pulse with @ 50% of peak (W50): \_\_\_\_\_ msec. **i**  
Barycentric period (PO): \_\_\_\_\_ sec. **i**  
Dispersion Measure (DM): \_\_\_\_\_ cm<sup>-3</sup> pc **i**  
Flux @ 400 Mhz (S400): \_\_\_\_\_ mJy **i**  
Flux @ 1400 Mhz (S1400): \_\_\_\_\_ mJy **i**  
Distance (Dist): \_\_\_\_\_ kpc \_\_\_\_\_ ly **i**  
Age (age): \_\_\_\_\_ years **i**  
Max Int. BW (no de-dispersion): \_\_\_\_\_ kHz **i**  
Expected S/N: \_\_\_\_\_ **i**  
Azimuth: \_\_\_\_\_ deg  
Elevation: \_\_\_\_\_ deg


10. Enter T Spillover. This is the contribution to overall noise of the ground and of surroundings of the dish. This is usually < 10.
11. Enter Integration time. This parameter defines the total time of observation in seconds . Usually this is between 1 and 7 hours.
12. Enter integration bandwidth. This is strictly depending on your receiving system.



# Murmur

## Initial setup of the program

By clicking on «other antenna» the program will load some default parameter that you can modify to reflect your specific station.

1. Enter Antenna gain in dBi
2. Enter the frequency at which you want to make the simulation. Please note the only two frequency intervals are available in Pulsar mode : 390Mhz-500Mhz and 1,000Mhz-1,500Mhz.
3. Enter line loss before LNA ( the preamplifier ). This value is usually very low and 0.1 dB should be ok.
4. Enter the noise figure of your pre-amplifier.
5. Enter the gain of your preamplifier.
6. Enter the loss of the line after the preamplifier. Please note that this value have a very low impact on overall system performance.
7. Enter the receiver Noise Figure. Please note that this value has a very low impact on overall system performance.
8. Enter T Sky. This value is strictly depending of frequency in use. Click  button for guidelines.

**Pulsar mode**

Location: \_\_\_\_\_ Latitude: \_\_\_\_\_ Longitude: \_\_\_\_\_ UTC Time: \_\_\_\_\_ Local Time: Thu Feb 3 19:02:47 2022

Current Time Zone Name : ora solare Europa occidentale (Not DST)

System evaluation mode:  Pulsar mode  Other antenna

SAVE current set as default | CALCULATE

TRACK noise sources | Culminations | Next 24h PSR visibility | Next 24h PSR tracking

CALCULATE Noise Y-Factor | 1 Month PSR visibility | 1 Month PSR tracking

Antenna gain: 30.00 dBi **1**

Frequency: 1303 Mhz **2**

Line loss before LNA: 0.1 dB **3**

LNA Noise figure: 0.23 dB **4**

LNA gain: 38 dB **5**

Line loss after LNA: 0.5 dB **6**

Receiver noise figure: 4 dB **7**

T sky: 4 K **8**

T spillover: 10 K **9**

Integration time: 18000 sec. **10**

Integration bandwidth: 10000 kHz **11**

Wave length: \_\_\_\_\_ m

Effective ant. aperture: \_\_\_\_\_ m<sup>2</sup> **i**

System noise temp.: \_\_\_\_\_ K **i**

System noise figure: \_\_\_\_\_ dB **i**

G/T ratio: \_\_\_\_\_ dB/K **i**

Noise floor: \_\_\_\_\_ dBm **i**

MDS: \_\_\_\_\_ mJy **i**

*The analysis does not take into account the polarization of the signal as this parameter is strongly depending on the specific Pulsar. Please evaluate carefully case by case as this may deteriorate performance up to 3dB.*

List of detectable PULSARS

Minimum S/N > 10

S/N > 10 suggested for reliable results

Sorted by S/N

Above horizon

Right Ascension(J2000 (RAJD)) \_\_\_\_\_ deg

Declination (DECJD) \_\_\_\_\_ deg

Pulse with @ 50% of peak (W50) \_\_\_\_\_ msec. **i**

Barycentric period (P0) \_\_\_\_\_ sec. **i**

Dispersion Measure (DM) \_\_\_\_\_ cm<sup>-3</sup> pc **i**

Flux @ 400 Mhz (S400) \_\_\_\_\_ mJy **i**

Flux @1400 Mhz (S1400) \_\_\_\_\_ mJy **i**

Distance (Dist) \_\_\_\_\_ kpc \_\_\_\_\_ ly **i**

Age (age) \_\_\_\_\_ years **i**

Max Int. BW (no de-dispersion) \_\_\_\_\_ kHz **i**

Expected S/N \_\_\_\_\_ **i**

Azimuth \_\_\_\_\_ deg

Elevation \_\_\_\_\_ deg

Show all PSR List

PLAN Observation

Select object to track

9. Enter T Spillover. This is the contribution to overall noise of the ground and of surroundings of the dish. This is strictly depending on the type of antenna
10. Enter Integration time. This parameter define the total time of observation in seconds . Usually this is between 1 and 7 hours.
11. Enter integration bandwidth. This is strictly depending on your receiving system.



# Murmur

## *Initial setup of the program*

**Next the location coordinates must be entered**

1. Click either on
  1. Set observer location with sexagesimal notations ( DMS ).
  2. Set observer location with QRA locator.
  3. Set observer location with decimal notation ( D.DDD ).
2. Enter data accordingly to your choice
3. Click confirm
4. Enter Name of location
5. Click Save data

**You can add multiple locations or reset everything by clicking «Reset Location DB».**

**Once you decided the location to use that is listed in the table, activate the location by clicking .**

6. Close the form by clicking «Close and return to main screen».

Set Observer location

Set observer location with sexagesimal notation ( DMS )

Set observer location with QRA locator

Set observer location with decimal notation (D.DDD)

Latitude (DMS) 43 5 32 N 43.0922 Calculated QRA Locator JN63GC92

Longitude (DMS) 12 34 38 E 12.5772

Confirm

QRA Locator JN63GC92 Calculated Latitude (D.DDD) 43.0938

Confirm Calculated Longitude (D.DDD) 12.5792

Latitude (D.DDD) 43.0922 Calculated Latitude (DMS) 43 05 31.9200 N

Longitude (D.DDD) 12.5772 Calculated Longitude (DMS) 12 34 37.9200 E

Confirm

Name of location Enter Location

Reset Location DB Save data

Close and return to main screen

Click on location to select



# Murmur

## Pulsar mode

The initialization is now completed and the following screen should be displayed. Murmur will show the ATNF Pulsar catalogue version and the number of Pulsars extracted from ATNF.csv file.

**Pulsar mode**

Location: Beviglie-Assisi    Latitude: 43.0938    Longitude: 12.5792    UTC Time: Sat Feb 5 17:57:31 2022    Local Time: Sat Feb 5 18:57:31 2022

Current Time Zone Name : ora solare Europa occidentale (Not DST)

System evaluation mode    SAVE current set as default    CALCULATE

Pulsar mode    SET Observation location    CALCULATE

TRACK noise sources    Culminations    Next 24h PSR visibility    Next 24h PSR tracking

CALCULATE Noise Y-Factor    1 Month PSR visibility    1 Month PSR tracking

Dish antenna     Other antenna

Dish diameter: 5 m    Dish efficiency: 69 %    Frequency: 1303 Mhz

Line loss before LNA: 0.1 dB    LNA Noise figure: 0.23 dB    LNA gain: 38 dB

Line loss after LNA: 0.5 dB    Receiver noise figure: 4 dB    T sky: 4 K    T spillover: 10 K

Integration time: 18000 sec.    Integration bandwidth: 56000 kHz

Wave length: m    Effective ant. aperture: m<sup>2</sup>    Dish area: m<sup>2</sup>    Far field: m    Antenna gain: dBi    HPBW: deg    System noise temp.: K    System noise figure: dB    G/T ratio: dB/K    Noise floor: dBm    MDS: mJy

**List of detectable PULSARS**

PULSARS extracted with S400 flow >0 : 714  
PULSARS extracted with S1400 flow >0 : 1902  
ATNF Pulsar catalogue Version : 1.66

Sorted by S/N

Above horizon

Minimum S/N: > 10

S/N >10 suggested for reliable results

Right AscensionJ2000 (RAJD): deg    Declination (DECJD): deg

Pulse with @ 50% of peak (W50): msec.    Barycentric period (P0): sec.    Dispersion Measure (DM): cm<sup>-3</sup> pc    Flux @ 400 Mhz (S400): mJy    Flux @1400 Mhz (S1400): mJy    Distance (Dist): kpc    ly    Age (age): years    Max Int. BW (no de-dispersion): kHz    Expected S/N

Azimuth: deg    Elevation: deg

Show all PSR List    PLAN Observation    Select object to track

*The analysis does not take into account the polarization of the signal as this parameter is strongly depending on the specific Pulsar. Please evaluate carefully case by case as this may deteriorate performance up to 3dB.*



# Murmur

## System evaluation mode

«System evaluation mode» allows the analysis of station parameters without frequency limitations and the visualization of Y-factor noise of the sun and of the most powerful and interesting cosmic radio sources in the entire frequency range of NOAA RSTN (Radio Solar Telescope Network) : 245Mhz-15400Mhz.

Pls note that in «System evaluation mode» «bandwidth» replaces «Integration bandwidth» of «Pulsar mode».

The image shows two screenshots of the Murmur software interface. The left screenshot is in 'Pulsar mode' and the right screenshot is in 'System evaluation mode'. A red arrow points from the 'System evaluation mode' button in the Pulsar mode window to the corresponding button in the System evaluation mode window. In the System evaluation mode window, the 'Bandwidth' field is highlighted with a red circle.

**Pulsar mode**

Location: Beviglie-Assisi, Latitude: 43.0938, Longitude: 12.5792, UTC Time: Sat Feb 5 17:57:31 2022, Local Time: Sat Feb 5 18:57:31 2022

Current Time Zone Name : ora solare Europa occidentale (Not DST)

System evaluation mode (circled in red)

Wave length: [ ] m, Effective ant. aperture: [ ] m<sup>2</sup>, Dish area: [ ] m<sup>2</sup>, Far field: [ ] m, Antenna gain: [ ] dBi, HPBW: [ ] deg, System noise temp.: [ ] K, System noise figure: [ ] dB, G/T ratio: [ ] dB/K, Noise floor: [ ] dBm, MDS: [ ] mJy

Minimum S/N: > 10

S/N > 10 suggested for reliable results

Right Ascension (RAJD): [ ] deg, Declination (DECJD): [ ] deg, Pulse with @ 50% of peak (W50): [ ] msec, Barycentric period (PO): [ ] sec, Dispersion Measure (DM): [ ] cm<sup>-3</sup> pc, Flux @ 400 Mhz (S400): [ ] mJy, Flux @ 1400 Mhz (S1400): [ ] mJy, Distance (Dist): [ ] kpc, Age (age): [ ] years, Max Int. BW (no de-dispersion): [ ] kHz, Expected S/N: [ ]

Azimuth: [ ] deg, Elevation: [ ] deg

**System evaluation mode**

Location: [ ], Latitude: [ ], Longitude: [ ]

Current Time Zone Name : ora solare Europa occidentale (Not DST)

System evaluation mode (circled in red)

Wave length: [ ] m, Effective ant. aperture: [ ] m<sup>2</sup>, Dish area: [ ] m<sup>2</sup>, Far field: [ ] m, Antenna gain: [ ] dBi, HPBW: [ ] deg, System noise temp.: [ ] K, System noise figure: [ ] dB, G/T ratio: [ ] dB/K, Noise floor: [ ] dBm

Dish diameter: 30.00 m, Dish efficiency: 69 %, Frequency: 1303 Mhz, Line loss before LNA: 0.1 dB, LNA Noise figure: 0.23 dB, LNA gain: 38 dB, Line loss after LNA: 0.5 dB, Receiver noise figure: 4 dB, T sky: 4 K, T spillover: 10 K

Bandwidth: 3000 Hz (circled in red)



# Murmur

## Pulsar mode

Click on «CALCULATE» to show Pulsars that are theoretically detectable.

- ✓ If you do not see any PULSAR listed on the box you can try to click on «Above Horizon» button to see also PSR below horizon.
- ✓ It is also possible to modify the S/N by clicking the «Minimum S/N» button. Please bear in mind that values below 10 make the PSR detection much more difficult !
- ✓ If you cannot still see any PSR you can try to increase «Integration time» and «Integration bandwidth ».

*Pulsar mode*

Location: Beviglie-Assisi    Latitude: 43.0938    Longitude: 12.5792    UTC Time: Sat Feb 5 18:00:51 2022    Local Time: Sat Feb 5 19:00:51 2022

Current Time Zone Name : ora solare Europa occidentale (Not DST)

System evaluation mode    SAVE current set as default    **CALCULATE**

Pulsar mode    SET Observation location

TRACK noise sources    Culminations    Next 24h PSR visibility    Next 24h PSR tracking

CALCULATE Noise Y-Factor    1 Month PSR visibility    1 Month PSR tracking

Dish antenna     Other antenna

Dish diameter: 5 m    Dish efficiency: 69 %    Frequency: 1303 Mhz

Line loss before LNA: 0.1 dB    LNA Noise figure: 0.23 dB    LNA gain: 38 dB

Line loss after LNA: 0.5 dB    Receiver noise figure: 4 dB    T sky: 4 K    T spillover: 10 K

Integration time: 18000 sec.    Integration bandwidth: 56000 kHz

Wave length: 0.23 m    Effective ant. aperture: 13.5 m<sup>2</sup>    Dish area: 19.63 m<sup>2</sup>    Far field: 217 m

Antenna gain: 35.06 dBi    HPBW: 3.22 deg    System noise temp.: 36.98 K    System noise figure: 0.52 dB    G/T ratio: 19.38 dB/K    Noise floor: -95.97 dBm    MDS: 7.51 mJy

*The analysis does not take into account the polarization of the signal as this parameter is strongly depending on the specific Pulsar. Please evaluate carefully case by case as this may deteriorate performance up to 3dB.*

List of detectable PULSARS

PULSARS extracted with S400 flow >0 : 714  
PULSARS extracted with S1400 flow >0 : 1902  
ATNF Pulsar catalogue Version : 1.66

Minimum S/N: > 10    S/N >10 suggested for reliable results

Sorted by S/N

Above horizon

B0329+54  
B0950+08  
B2021+51  
B2020+28  
B2016+28  
B0740-28  
B0355+54  
B0628-28  
B2154+40  
B2111+46  
B0823+26  
B2310+42  
B0301+19  
B0919+06  
B0450+55

Show all PSR List    PLAN Observation    Select object to track

Right Ascension J2000 (RAJD):    deg  
Declination (DECJD):    deg  
Pulse with @ 50% of peak (W50):    msec.    i  
Barycentric period (P0):    sec.    i  
Dispersion Measure (DM):    cm<sup>-3</sup> pc    i  
Flux @ 400 Mhz (S400):    mJy    i  
Flux @1400 Mhz (S1400):    mJy    i  
Distance (Dist):    kpc    ly    i  
Age (age):    years    i  
Max Int. BW (no de-dispersion):    kHz    i  
Expected S/N:    i  
Azimuth:    deg  
Elevation:    deg



# Murmur

## Pulsar mode

Click on any of the PSR listed to show PSR parameters to visualize the expected S/N and the real time Azimuth and Elevation based on your location.

**Pulsar mode**

Location: Beviglie-Assisi    Latitude: 43.0938    Longitude: 12.5792    UTC Time: Sat Feb 5 18:02:49 2022    Local Time: Sat Feb 5 19:02:49 2022

Current Time Zone Name : ora solare Europa occidentale (Not DST)

Rev. History    Help

RESET Settings and EXIT

Check for updates    EXIT

System evaluation mode    SAVE current set as default    CALCULATE

Pulsar mode    SET Observation location    CALCULATE Noise Y-Factor

TRACK noise sources    Culminations    Next 24h PSR visibility    Next 24h PSR tracking

1 Month PSR visibility    1 Month PSR tracking

Dish antenna     Other antenna

Dish diameter: 5 m  
Dish efficiency: 69 %  
Frequency: 1303 Mhz  
Line loss before LNA: 0.1 dB  
LNA Noise figure: 0.23 dB  
LNA gain: 38 dB  
Line loss after LNA: 0.5 dB  
Receiver noise figure: 4 dB  
T sky: 4 K  
T spillover: 10 K

Integration time: 18000 sec.  
Integration bandwidth: 56000 kHz

Wave length: 0.23 m  
Effective ant. aperture: 13.5 m<sup>2</sup>  
Dish area: 19.63 m<sup>2</sup>  
Far field: 217 m  
Antenna gain: 35.06 dBi  
HPBW: 3.22 deg  
System noise temp.: 36.98 K  
System noise figure: 0.52 dB  
G/T ratio: 19.38 dB/K  
Noise floor: -95.97 dBm  
MDS: 7.51 mJy

*The analysis does not take into account the polarization of the signal as this parameter is strongly depending on the specific Pulsar. Please evaluate carefully case by case as this may deteriorate performance up to 3dB.*

List of detectable PULSARS  
PULSARS extracted with S400 flow >0 : 714  
PULSARS extracted with S1400 flow >0 : 1902  
ATNF Pulsar catalogue Version : 1.66

Sorted by S/N

Above horizon

**B0329+54**

B0950+08  
B2021+51  
B2020+28  
B2016+28  
B0740-28  
B0355+54  
B0628-28  
B2154+40  
B2111+46  
B0823+26  
B2310+42  
B0301+19  
B0919+06  
B0450+55

Minimum S/N: > 10  
S/N > 10 suggested for reliable results

Right AscensionJ2000 (RAJD): 53.25 deg  
Declination (DECJD): 54.58 deg  
Pulse with  $\theta$  50% of peak (W50): 6.6 msec.  
Barycentric period (PO): 0.71452 sec.  
Dispersion Measure (DM): 26.76 cm<sup>-3</sup> pc  
Flux @ 400 Mhz (S400): 1500.0 mJy  
Flux @1400 Mhz (S1400): 203.0 mJy  
Distance (Dist): 1.70 kpc / 5528.4 ly  
Age (age): 5.53e+06 years  
Max Int. BW (no de-dispersion): 34 Mhz  
Expected S/N: 280.0  
Azimuth: 343.48 deg  
Elevation: 77.88 deg

Show all PSR List  
PLAN Observation  
Select object to track



# Murmur

## *Pulsar mode*

By clicking on «Track noise sources» the following screen will be displayed with the real time position ( Azimuth and Elevation ) of the selected PSR and of the strongest cosmic noise sources.

The screen will also show the strongest Quasar ( 3C273 ), the FRB 20220912A [1], the FRB 20201124A a repeating Fast Radio Burst in a globular cluster [2] [3] and the FRB Fast Radio Burst-emitting Magnetar SGR 1935+2154 [4].

	Azimuth Deg.	Elevation Deg.
Moon	6.54	-30.38
Sun	326.33	-16.05
Cygnus A	66.13	37.86
Taurus A	325.19	-16.91
Cassiopeia A	27.83	22.14
Sagittarius A	146.01	9.64
VIRGO A	240.36	43.97
3C273	232.53	35.55
FRB 20220912A	36.57	15.92
FRB 20201124A	332.65	-15.72
SGR 1935+2154	27.58	-20.11
<i>B1749-28</i>	144.30	9.57

***Please note that SGR 1935+2154 is not reported in MURMUR internal Pulsar data base as no S400 and S1400 were published.***

***To find details of this Magnetar visit :  
<https://www.atnf.csiro.au/people/pulsar/psrcat/>***

[1] ATEL #15691

[2] L. Piro, G. Bruni, E. Troja<sup>2</sup>, B. O'Connor, F. Panessa, R. Ricci et al.: « The Fast Radio Burst FRB 20201124A in a star forming region: constraints to the progenitor and multiwavelength counterparts», A&A Volume 656, December 2021

[3] <https://astropeiler.de/frb20201124a?msclkid=23a40c3faffa11ec88308a9f01282ad1>

[4] Starr, Michelle (16 November 2020). "It's Official: The Fast Radio Burst Coming From Within Our Galaxy Is Repeating". *ScienceAlert*. Retrieved 17 November 2020.



# Murmur

## Pulsar mode

The four buttons on the right side allow to predict visibility ( above the horizon ) or full tracking of the selected PSR for the next 24 hours or for tyhe full month.

**Pulsar mode**

Location: Beviglie-Assisi    Latitude: 43.0938    Longitude: 12.5792    UTC Time: Sat Feb 5 18:02:49 2022    Local Time: Sat Feb 5 19:02:49 2022  
Current Time Zone Name : ora solare Europa occidentale (Not DST)

Rev. History    Help  
RESET Settings and EXIT  
Check for updates    EXIT

System evaluation mode    SAVE current set as default    CALCULATE  
Pulsar mode    SET Observation location    CALCULATE

TRACK noise sources    Culminations    Next 24h PSR visibility    Next 24h PSR tracking  
CALCULATE Noise Y-Factor    1 Month PSR visibility    1 Month PSR tracking

Dish antenna     Other antenna

Dish diameter	5	m
Dish efficiency	69	%
Frequency	1303	Mhz
Line loss before LNA	0.1	dB
LNA Noise figure	0.23	dB
LNA gain	38	dB
Line loss after LNA	0.5	dB
Receiver noise figure	4	dB
T sky	4	K <i>i</i>
T spillover	10	K <i>i</i>
Integration time	18000	sec.
Integration bandwidth	56000	kHz

Wave length	0.23	m
Effective ant. aperture	13.5	m <sup>2</sup> <i>i</i>
Dish area	19.63	m <sup>2</sup>
Far field	217	m <i>i</i>
Antenna gain	35.06	dBi <i>i</i>
HPBW	3.22	deg <i>i</i>
System noise temp.	36.98	K <i>i</i>
System noise figure	0.52	dB <i>i</i>
G/T ratio	19.38	dB/K <i>i</i>
Noise floor	-95.97	dBm <i>i</i>
MDS	7.51	mJy <i>i</i>

*The analysis does not take into account the polarization of the signal as this parameter is strongly depending on the specific Pulsar. Please evaluate carefully case by case as this may deteriorate performance up to 3dB.*

List of detectable PULSARS    Minimum S/N > 10  
PULSARS extracted with S400 flow > 0 : 714  
PULSARS extracted with S1400 flow > 0 : 1902  
ATNF Pulsar catalogue Version : 1.66  
S/N > 10 suggested for reliable results

Sorted by S/N  
Above horizon

B0329+54	Right Ascension(J2000 (RAJD))	53.25	deg
B0950+08	Declination (DECJD)	54.58	deg
B2021+51	Pulse with @ 50% of peak (W50)	6.6	msec. <i>i</i>
B2020+28	Barycentric period (PO)	0.71452	sec. <i>i</i>
B2016+28	Dispersion Measure (DM)	26.76	cm <sup>-3</sup> pc <i>i</i>
B0740-28	Flux @ 400 Mhz (S400)	1500.0	mJy <i>i</i>
B0355+54	Flux @1400 Mhz (S1400)	203.0	mJy <i>i</i>
B0628-28	Distance (Dist)	1.70	kpc
B2154+40	Age (age)	5.53e+06	years <i>i</i>
B2111+46	Max Int. BW (no de-dispersion)	34	Mhz <i>i</i>
B0823+26	Expected S/N	280.0	<i>i</i>
B2310+42	Azimuth	343.48	deg
B0301+19	Elevation	77.88	deg
B0919+06			
B0450+55			

Show all PSR List  
PLAN Observation  
Select object to track



# Murmur

## Pulsar mode

The «Sorted by S/N» button triggers a procedure that allows the sorting of the Data Base by any Pulsar parameter.

**Pulsar mode**

Location: Beviglie-Assisi    Latitude: 43.0938    Longitude: 12.5792    UTC Time: Sat Feb 5 18:02:49 2022    Local Time: Sat Feb 5 19:02:49 2022  
Current Time Zone Name : ora solare Europa occidentale (Not DST)

System evaluation mode    SAVE current set as default    CALCULATE

Pulsar mode    SET Observation location    CALCULATE

Dish antenna     Other antenna

Dish diameter: 5 m  
Dish efficiency: 69 %  
Frequency: 1303 Mhz  
Line loss before LNA: 0.1 dB  
LNA Noise figure: 0.23 dB  
LNA gain: 38 dB  
Line loss after LNA: 0.5 dB  
Receiver noise figure: 4 dB  
T sky: 4 K  
T spillover: 10 K

Integration time: 18000 sec.  
Integration bandwidth: 56000 kHz

Wave length: 0.23 m  
Effective ant. aperture: 13.5 m<sup>2</sup>  
Dish area: 19.63 m<sup>2</sup>  
Far field: 217 m  
Antenna gain: 35.06 dBi  
HPBW: 3.22 deg  
System noise temp.: 36.98 K  
System noise figure: 0.52 dB  
G/T ratio: 19.38 dB/K  
Noise floor: -95.97 dBm  
MDS: 7.51 mJy

*The analysis does not take into account the polarization of the signal as this parameter is strongly depending on the specific Pulsar. Please evaluate carefully case by case as this may deteriorate performance up to 3dB.*

TRACK noise sources    Culminations    Next 24h

Sorted by S/N

Right AscensionJ2000 (RAJD)  
Declination (DECJD)  
Pulse with @ 50% of peak (W50)  
Barycentric period (P0)  
Dispersion Measure (DM)  
Flux @ 400 Mhz (S400)  
Flux @1400 Mhz (S1400)  
Distance (kpc)  
Age (years)  
 Expected S/N

List of detectable PULSARS

Right AscensionJ2000	Declination	Pulse with @ 50% of	Barycentric period (P0)	Dispersion Measure (DM)	Flux @ 400 Mhz (S400)	Flux @1400 Mhz (S1400)	Distance (Dist)	Age (age)	Max Int. BW (no de-dispersion)	Expected S/N	Azimuth	Elevation
B0329+54			0.71452	26.76	1500.0	203.0	1.70	5.53e+06	34	280.0	343.48	77.88
B0950+08												
B2021+51												
B2020+28												
B2016+28												
B0740-28												
B0355+54												
B0628-28												
B2154+40												
B2111+46												
B0823+26												
B2310+42												
B0301+19												
B0919+06												
B0450+55												

Show all PSR List

PLAN Observation

Select object to track



# Murmur

## Pulsar mode

By clicking the «Show all PSR List» Murmur will show the list of all Pulsars extracted from ATNF.csv file sorted as specified.

Frequency : 1303 Mhz Sorted by S/N

PSR #	PSR name	RA(Deg)	DEC(Deg)	DM(cm^-3 pc)	W50(ms)	S400(mJy)	S1400(mJy)	Barycentric Period(sec.)	Distance (kpc)	Age (years)	Expected S/N
0	B0833-45	128.8359	-45.1764	67.770	1.400	5000.00	1050.00	0.08932800	0.28	1.13e+04	16862.018
1	B1641-45	251.2053	-45.9860	478.660	8.000	375.00	300.00	0.45507800	4.50	3.59e+05	4544.526
2	B0329+54	53.2475	54.5787	26.760	6.600	1500.00	203.00	0.71452000	1.70	5.53e+06	4260.267
3	B0437-4715	69.3162	-47.2525	2.640	0.141	550.00	150.20	0.00575700	0.16	1.59e+09	1920.855
4	B0950+08	148.2888	7.9266	2.970	8.900	400.00	100.00	0.25306500	0.26	1.75e+07	1061.371
5	B1749-28	268.2445	-28.1104	50.370	6.100	1100.00	47.80	0.56255800	0.20	1.10e+06	925.124
6	B0835-41	129.3383	-41.5874	147.200	4.400	197.00	35.00	0.75162500	1.50	3.37e+06	924.247
7	B1933+16	293.9493	16.2778	158.520	6.000	242.00	58.00	0.35873800	3.70	9.47e+05	901.154
8	B0736-40	114.6344	-40.7109	160.900	22.700	190.00	112.60	0.37492100	1.60	4.32e+06	898.781
9	B2045-16	312.1485	-16.2790	11.460	9.800	116.00	22.00	1.96157200	0.95	2.84e+06	629.136
10	B1240-64	190.8213	-64.3899	297.090	5.000	110.00	34.20	0.38848500	2.00	1.37e+06	606.926
11	B1451-68	223.9997	-68.7276	8.610	12.400	350.00	64.00	0.26337700	0.43	4.22e+07	583.454
12	B1133+16	174.0130	15.8539	4.840	5.900	257.00	20.00	1.18791300	0.37	5.04e+06	573.635
13	B1642-03	251.2585	-3.2994	35.760	3.400	393.00	25.76	0.38769000	3.85	3.45e+06	554.954
14	B1426-66	217.6697	-66.3849	65.100	3.900	130.00	16.30	0.78544300	1.33	4.48e+06	467.576
15	B1556-44	239.9230	-44.6461	55.940	6.500	110.00	37.10	0.25705600	2.30	4.00e+06	466.756
16	B2021+51	305.7078	51.9140	22.550	7.400	77.00	27.00	0.52919700	1.80	2.74e+06	459.430
17	B0906-49	137.1478	-49.2181	180.370	0.900	28.00	20.00	0.10676900	1.00	1.12e+05	439.556
18	B2020+28	305.6544	28.9064	24.630	12.000	71.00	38.00	0.34340200	2.10	2.84e+06	404.661
19	B1727-47	262.9257	-47.7434	123.060	17.100	190.00	27.00	0.82982900	0.70	8.04e+04	377.189
20	B2016+28	304.5160	28.6651	14.200	14.900	314.00	30.00	0.55795300	0.98	5.97e+07	367.003
21	B1929+10	293.0586	10.9926	3.180	5.700	303.00	28.70	0.22651900	0.31	3.10e+06	361.979
22	B1323-58	201.7426	-58.9915	287.170	5.600	120.00	18.00	0.47799400	3.00	2.34e+06	335.005
23	B1054-62	164.1066	-62.9799	320.620	17.400	45.00	34.00	0.42245100	2.40	1.87e+06	332.414
24	B0740-28	115.7044	-28.3788	73.730	4.200	296.00	26.00	0.16676200	2.00	1.57e+05	327.777
25	B1742-30	266.4846	-30.6730	88.370	6.100	66.00	21.00	0.36743400	0.20	5.46e+05	327.514
26	B1323-62	201.8216	-62.3793	318.480	8.800	135.00	21.00	0.52992900	4.00	4.47e+05	327.470
27	B0355+54	59.7238	54.2205	57.140	3.900	46.00	23.00	0.15638400	1.00	5.64e+05	291.426
28	B1737-30	265.1409	-30.2621	151.960	2.400	24.60	8.90	0.60688700	0.40	2.06e+04	286.219
29	B0959-54	150.4077	-55.1188	130.320	7.200	80.00	10.00	1.43663100	0.30	4.41e+05	285.520
30	B1557-50	240.2209	-50.7392	262.790	4.300	*	21.00	0.19260500	6.90	6.03e+05	281.603
31	B0628-28	97.7059	-28.5785	34.420	63.300	206.00	31.90	1.24441900	0.32	2.77e+06	279.226

Local Time: 32 2022 Thu Feb 3 19:15:32 2022

Rev. History Help

RESET Settings and EXIT

Check for updates EXIT

TRACK noise sources Culminations Next 24h PSR visibility Next 24h PSR tracking

CALCULATE Noise Y-Factor 1 Month PSR visibility 1 Month PSR tracking

List of detectable PULSARS Minimum S/N > 10

PULSARS extracted with S400 flow > 0 : 714

PULSARS extracted with S1400 flow > 0 : 1902

ATNF Pulsar catalogue Version : 1.66

Sorted by S/N

Above horizon

B0329+54

B0950+08

B2021+51

B2020+28

B2016+28

B0740-28

B0355+54

B0628-28

B2154+40

B2111+46

B0823+26

B2310+42

B0301+19

Right Ascension J2000 (RAJD) 53.25 deg

Declination (DECJD) 54.58 deg

Pulse with @ 50% of peak (W50) 6.6 msec

Barycentric period (PO) 0.71452 sec

Dispersion Measure (DM) 26.76 cm^-3 pc

Flux @ 400 Mhz (S400) 1500.0 mJy

Flux @ 1400 Mhz (S1400) 203.0 mJy

Distance (Dist) 1.70 kpc 5528.4 ly

Age (age) 5.53e+06 years

Max Int. BW (no de-dispersion) 34 Mhz

Expected S/N 4260.3

Azimuth 340.42 deg

Elevation 77.61 deg

Show all PSR List

PLAN Observation

Select object to track

Line loss after LNA 0.5 dB

Receiver noise figure 4 dB

T sky 4 K

T spillover 10 K

Integration time 18000 sec.

Integration bandwidth 10000 kHz

System noise figure 0.52 dB

G/T ratio 34.95 dB/K

Noise floor -103.46 dBm

MDS 0.49 mJy

Performance of the system is strongly depending on the specific Pulsar. Please evaluate carefully case by case as this may deteriorate performance up to 3dB.



# Murmur

## Pulsar mode

By clicking the «Select object to track » Murmur will allow to select on object and the tracking data will be shown in a separate Form.

**Pulsar mode**

Location: Beviglie-Assisi    Latitude: 43.0938    Longitude: 12.5792    UTC Time: Sat Feb 5 18:02:49 2022    Local Time: Sat Feb 5 19:02:49 2022

Current Time Zone Name : ora solare Europa occidentale (Not DST)

System evaluation mode    SAVE current set as default    CALCULATE

Pulsar mode    SET Observation location

Dish antenna     Other antenna

Dish diameter: 5 m    Dish efficiency: 69 %    Frequency: 1303 Mhz

Line loss before LNA: 0.1 dB    LNA Noise figure: 0.23 dB    LNA gain: 38 dB

Line loss after LNA: 0.5 dB    Receiver noise figure: 4 dB    T sky: 4 K    T spillover: 10 K

Integration time: 18000 sec.    Integration bandwidth: 56000 kHz

Wave length: 0.23 m    Effective ant. aperture: 13.5 m<sup>2</sup>    Dish area: 19.63 m<sup>2</sup>    Far field: 217 m    Antenna gain: 35.06 dBi    HPBW: 3.22 deg    System noise temp.: 36.98 K    System noise figure: 0.52 dB    G/T ratio: 19.38 dB/K    Noise floor: -95.97 dBm    MDS: 7.51 mJy

*The analysis does not take into account the polarization of the signal as this parameter is strongly depending on the specific Pulsar. Please evaluate carefully case by case as this may deteriorate performance up to 3dB.*

TRACK noise sources    Culminations    Next 24h PSR visibility    Next 24h PSR tracking

CALCULATE Noise Y-Factor    1 Month PSR visibility    1 Month PSR tracking

List of detectable PULSARS    Minimum S/N > 10    S/N > 10 suggested for reliable results

PULSARS extracted with S400 flow > 0 : 714  
PULSARS extracted with S1400 flow > 0 : 1902  
ATNF Pulsar catalogue Version : 1.66

Sorted by S/N    Above horizon

B0329+54	Right AscensionJ2000 (RAJD)	53.25	deg
B0950+08	Declination (DECJD)	54.58	deg
B2021+51	Pulse width @ 50% of peak (W50)	6.6	msec.
B2020+28	Barycentric period (P0)	0.71452	sec.
B2016+28	Dispersion Measure (DM)	26.76	cm <sup>-3</sup> pc
B0740-28	Flux @ 400 Mhz (S400)	1500.0	mJy
B0355+54	Flux @ 1400 Mhz (S1400)	203.0	mJy
B0628-28	Distance (Dist)	1.70	kpc
B2154+40	Age (age)	5.53e+06	years
B2111+46	Max Int. BW (no de-dispersion)	34	Mhz
B0823+26	Expected S/N	280.0	
B2310+42	Azimuth	343.48	deg
B0301+19	Elevation	77.88	deg
B0919+06			
B0450+55			

Show all PSR List    PLAN Observation    **Select object to track**

Tracking

**Sun**    Tracking Azimuth: 269.26 deg    Tracking Elevation: -23.56 deg

Hide main screen    Exit

Noise sources tracking

	Azimuth Deg.	Elevation Deg.
Moon	6.54	-30.38
Sun	326.33	-16.05
Cygnus A	66.13	37.86
Taurus A	325.19	-16.91
Cassiopeia A	27.83	22.14
Sagittarius A	146.01	9.64
VIRGO A	240.36	43.97
3C273	232.53	35.55
FRB 20220912A	36.57	15.92
FRB 20201124A	332.65	-15.72
SGR 1935+2154	27.58	-20.11
B1749-28	144.30	9.57

Hide main screen    Exit

**When this feature is active Murmur will work in conjunction with the program «PstRotator» from Codrut YO3DMU [https://www.qsl.net/yo3dmu/index\\_Page346.htm](https://www.qsl.net/yo3dmu/index_Page346.htm) allowing direct control of antenna rotators.**



# Murmur

## Pulsar mode

By selecting «Culminations» Murmur will calculate the culmination of the objects shown in the upper side of the screen . Please note that this calculation may take long time .

Next 30 culminations - THIS CAN TAKE SOME TIME !

Buttons: Moon, Sun, Cygnus-A, Taurus-A, Cassiopeia-A, Sagittarius-A, 3C273, B0329+54

Date Time ( UTC )	Date Time ( Local )	Azimuth ( Deg.)	Elevation (Deg.)
Sun Feb 6 15:46:51 2022	Sun Feb 6 16:46:51 2022	181.22	54.05
Mon Feb 7 16:29:25 2022	Mon Feb 7 17:29:25 2022	181.09	59.39
Tue Feb 8 17:12:52 2022	Tue Feb 8 18:12:52 2022	180.94	64.08
Wed Feb 9 17:57:55 2022	Wed Feb 9 18:57:55 2022	180.74	67.96
Thu Feb 10 18:44:59 2022	Thu Feb 10 19:44:59 2022	180.51	70.86
Fri Feb 11 19:34:01 2022	Fri Feb 11 20:34:01 2022	180.26	72.61
Sat Feb 12 20:24:26 2022	Sat Feb 12 21:24:26 2022	179.98	73.09
Sun Feb 13 21:15:17 2022	Sun Feb 13 22:15:17 2022	179.68	72.21
Mon Feb 14 22:05:32 2022	Mon Feb 14 23:05:32 2022	179.39	69.99
Tue Feb 15 22:54:23 2022	Tue Feb 15 23:54:23 2022	179.14	66.53
Wed Feb 16 23:41:32 2022	Thu Feb 17 00:41:32 2022	178.95	62.02
Fri Feb 18 00:27:09 2022	Fri Feb 18 01:27:09 2022	178.79	56.68
Sat Feb 19 01:11:55 2022	Sat Feb 19 02:11:55 2022	178.70	50.77
Sun Feb 20 01:56:43 2022	Sun Feb 20 02:56:43 2022	178.66	44.58
Mon Feb 21 02:42:41 2022	Mon Feb 21 03:42:41 2022	178.69	38.38
Tue Feb 22 03:31:05 2022	Tue Feb 22 04:31:05 2022	178.79	32.49
Wed Feb 23 04:23:07 2022	Wed Feb 23 05:23:07 2022	178.97	27.25
Thu Feb 24 05:19:41 2022	Thu Feb 24 06:19:41 2022	179.24	23.05
Fri Feb 25 06:20:46 2022	Fri Feb 25 07:20:46 2022	179.60	20.32
Sat Feb 26 07:24:54 2022	Sat Feb 26 08:24:54 2022	180.02	19.40
Sun Feb 27 08:29:19 2022	Sun Feb 27 09:29:19 2022	180.44	20.45
Mon Feb 28 09:31:08 2022	Mon Feb 28 10:31:08 2022	180.81	23.35
Tue Mar 1 10:28:28 2022	Tue Mar 1 11:28:28 2022	181.09	27.75
Wed Mar 2 11:21:01 2022	Wed Mar 2 12:21:01 2022	181.26	33.20
Thu Mar 3 12:09:26 2022	Thu Mar 3 13:09:26 2022	181.34	39.24
Fri Mar 4 12:54:54 2022	Fri Mar 4 13:54:54 2022	181.34	45.47
Sat Mar 5 13:38:41 2022	Sat Mar 5 14:38:41 2022	181.29	51.57
Sun Mar 6 14:21:56 2022	Sun Mar 6 15:21:56 2022	181.18	57.28
Mon Mar 7 15:05:40 2022	Mon Mar 7 16:05:40 2022	181.03	62.39
Tue Mar 8 15:50:40 2022	Tue Mar 8 16:50:40 2022	180.84	66.71

Please note that above table is calculated assuming DST NOT ACTIVE

Buttons: Hide main screen, Exit

Integration bandwidth: 56000 kHz

Calculation options: TRACK noise source (Culminations), CALCULATE Noise Y-Factor, Next 24h PSR visibility, Next 24h PSR tracking, 1 Month PSR visibility, 1 Month PSR tracking

JTC Time: Sat Feb 5 18:02:49 2022, Local Time: Sat Feb 5 18:02:49 2022

Buttons: Rev. History, Help, RESET Settings and EXIT, Check for updates, EXIT

List of detectable PULSARS

Sorted by S/N	Right Ascension J2000 (RAJD)	Minimum S/N	Declination (DECJD)
B0329+54	53.25 deg	> 10	54.58 deg
B0950+08			
B2021+51			
B2020+28			
B2016+28			
B0740-28			
B0355+54			
B0628-28			
B2154+40			
B2111+46			
B0823+26			
B2310+42			
B0301+19			
B0919+06			
B0450+55			

Parameters for B0329+54:

- Pulse width @ 50% of peak (W50): 6.6 msec
- Barycentric period (P0): 0.71452 sec
- Dispersion Measure (DM): 26.76 cm<sup>-3</sup> pc
- Flux @ 400 Mhz (S400): 1500.0 mJy
- Flux @ 1400 Mhz (S1400): 203.0 mJy
- Distance (Dist): 1.70 kpc, 5528.4 ly
- Age (age): 5.53e+06 years
- Max Int. BW (no de-dispersion): 34 Mhz
- Expected S/N: 280.0
- Azimuth: 343.48 deg
- Elevation: 77.88 deg

Buttons: Show all PSR List, PLAN Observation, Select object to track



# Murmur

## Pulsar mode and System evaluation mode

By selecting «CALCULATE Noise Y-Factor» Murmur will allow Noise calculations.

- ✓ Click on «Download latest flow data» to download latest data from the NOAA ftp site <https://www.swpc.noaa.gov/>

**Pulsar mode**

Location: Beviglie-Assisi, Latitude: 43.0938, Longitude: 12.5792, UTC Time: Sat Feb 5 18:02:49 2022, Local Time: Sat Feb 5 19:02:49 2022

System evaluation mode: **CALCULATE**

Wave length: 0.23 m, Effective ant. aperture: 13.5 m<sup>2</sup>, Dish area: 19.63 m<sup>2</sup>, Far field: 217 m, Antenna gain: 35.06 dBi, HPBW: 3.22 deg, System noise temp: 36.98 K, System noise figure: 0.52 dB, G/T ratio: 19.38 dB/K, Noise floor: -95.97 dBm, MDS: 7.51 mJy

List of detectable PULSARS: Right Ascension J2000 (RAJ20): 53.25 deg, Declination (DECJ20): 54.58 deg, Pulse with @ 50% of peak (W50): 6.6 msec, Barycentric period (PO): 0.71452 sec, Dispersion Measure (DM): 26.76 cm<sup>-3</sup> pc, Flux @ 400 Mhz (S400): 1500.0 mJy, Flux @ 1400 Mhz (S1400): 203.0 mJy, Distance (Dist): 1.70 kpc, Age (age): 5.53e+06 years, Max Int. BW (no de-dispersion): 34 MHz, Expected S/N: 280.0, Azimuth: 343.48 deg, Elevation: 77.88 deg

Sun flux and sun Y-factor noise

Sun flux data downloaded from: ftp://ftp.swpc.noaa.gov/pub/lists/radio/rad.txt (-1 stands for data not available)

Frequency: [ ] Mhz, Sun flux (calculated): [ ] Jy, Sun noise Y-factor: [ ] dB, Measured noise: [ ] dB

Download latest sun flow data and calculate sun noise

#	Date	Hour	Frequency (Mhz)	Antenna Gain (dBi)	Tsys (K)	SFU (Jy)	Expected Noise (dB)	Measured Noise (dB)	Delta (dB)	Comments
1	16/05/2018	11:35:29	1296	33.617	36.980	434616	16.31	15	1.312	
2	17/05/2018	12:20:12	1303	33.664	36.980	468301	16.62	16.63	-0.00	ONLY Sun Noise
3	18/05/2018	09:33:32	1303	33.664	36.980	438895	16.35	15.1	1.254	
4	19/05/2018	10:47:07	1303	33.664	36.980	426826	16.23	14.8	1.436	
5	20/05/2018	10:50:56	1303	33.664	36.980	417967	16.14	14.9	1.247	

When the download from the observatory site will be completed the Sun flux and the Y-factor noise at the required frequency will be displayed.

Sun flux and sun Y-factor noise

Sun flux data downloaded from: ftp://ftp.swpc.noaa.gov/pub/lists/radio/rad.txt (-1 stands for data not available)

2022 Feb 3

Mhz	0500 UTC	1200 UTC	1700 UTC	1700 UTC	2000 UTC	2300 UTC	2300 UTC	Best set
245	40	42	-1	-1	-1	-1	-1	40
410	43	40	-1	-1	-1	-1	-1	43
610	51	-1	-1	-1	-1	-1	-1	51
1415	97	89	-1	-1	-1	-1	-1	97
2695	134	-1	-1	-1	-1	-1	-1	134
2800	-1	-1	-1	-1	-1	-1	-1	-1
4995	166	181	-1	-1	-1	-1	-1	166
8800	260	252	-1	-1	-1	-1	-1	260
15400	555	503	-1	-1	-1	-1	-1	555

Sun flux (calculated): 909878 Jy, Sun noise Y-factor: 20.85 dB

#	Date	Hour	Frequency (Mhz)	Antenna Gain (dBi)	Tsys (K)	SFU (Jy)	Expected Noise (dB)	Measured Noise (dB)	Delta (dB)	Comments
1	16/05/2018	11:35:29	1296	33.617	36.980	434616	16.31	15	1.312	
2	17/05/2018	12:20:12	1303	33.664	36.980	468301	16.62	16.63	-0.00	ONLY Sun Noise
3	18/05/2018	09:33:32	1303	33.664	36.980	438895	16.35	15.1	1.254	
4	19/05/2018	10:47:07	1303	33.664	36.980	426826	16.23	14.8	1.436	
5	20/05/2018	10:50:56	1303	33.664	36.980	417967	16.14	14.9	1.247	



# Murmur

## Pulsar mode and System evaluation mode

After calculating the Sun noise Y-factor it is possible to enter and save the measurements taken together with some comment. The program will also allow the edit of the saved data and the export in .csv format for further analysis.

Please note that Noise Y-factor in «Pulsar mode» is calculated only in two frequency windows (400 Mhz and 1300 Mhz ) while when in «system evaluation mode » the calculations are performed for extended frequency range .

Sun flux and sun Y-factor noise

Sun flux data downloaded from : <ftp://ftp.swpc.noaa.gov/pub/lists/radio/rad.txt> ( -1 stands for data not available )

2022 Feb 3	Learmonth 0500 UTC	San Vito 1200 UTC	Sag Hill 1700 UTC	Penticton 1700 UTC	Penticton 2000 UTC	Palehua 2300 UTC	Penticton 2300 UTC	Best set
Mhz								
245	40	42	-1	-1	-1	-1	-1	40
410	43	40	-1	-1	-1	-1	-1	43
610	51	-1	-1	-1	-1	-1	-1	51
1415	97	89	-1	-1	-1	-1	-1	97
2695	134	-1	-1	-1	-1	-1	-1	134
2800	-1	-1	-1	-1	-1	-1	-1	-1
4995	166	181	-1	-1	-1	-1	-1	166
8800	260	252	-1	-1	-1	-1	-1	260
15400	555	503	-1	-1	-1	-1	-1	555

Download latest sun flow data and calculate sun noise

Show Y-factor for all noise sources

Frequency: 1303 Mhz  
Sun flux ( calculated ): 909878 Jy  
Sun noise Y-factor: 20.85 dB  
Measured noise: 18 dB   
Comment: Example  
*Sun flux is calculated by quadratic spline interpolation*

Noise measurements Data Base

#	Date	Hour	Frequency ( Mhz )	Antenna Gain ( dBi )	Tsys ( K )	SFU ( Jy )	Expected Noise ( dB )	Measured Noise ( dB )	Delta ( dB )	Comments
259	01/02/2022	12:27:10	1303	35.062	36.980	872409	20.67	18.3	2.372	-78.1 210 65 s
260	02/02/2022	12:07:42	1303	35.062	36.980	891374	20.76	18.2	2.564	-78.1 210 65 s
261	03/02/2022	11:18:15	1303	35.062	36.980	909878	20.85	18.1	2.752	-78.1 210 65 s
262	03/02/2022	19:44:02	1303	35.062	36.980	909878	20.85	18	2.853	Example

Delete row  Delete All Data Hide main screen Close



# Murmur

## Pulsar mode and System evaluation mode

By activating «Show Y-Factor for all noise sources» Murmur calculates the expected Noise Y-factor of the major noise sources.

Sun flux and sun Y-factor noise

Sun flux data downloaded from : <ftp://ftp.swpc.noaa.gov/pub/lists/radio/rad.txt> ( -1 stands for data not available )

2022 Feb 3

Mhz	Learmonth 0500 UTC	San Vito 1200 UTC	Sag Hill 1700 UTC	Penticton 1700 UTC	Penticton 2000 UTC	Palehua 2300 UTC	Penticton 2300 UTC	Best set
245	40	42	-1	-1	-1	-1	-1	40
410	43	40	-1	-1	-1	-1	-1	43
610	51	-1	-1	-1	-1	-1	-1	51
1415	97	89	-1	-1	-1	-1	-1	97
2695	134	-1	-1	-1	-1	-1	-1	134
2800	-1	-1	-1	-1	-1	-1	-1	-1
4995	166	181	-1	-1	-1	-1	-1	166
8800	260	252	-1	-1	-1	-1	-1	260
15400	555	503	-1	-1	-1	-1	-1	555

Download latest sun flow data and calculate sun noise

Frequency 1303 Mhz  
Sun flux (calculated) 909878 Jy  
Sun noise Y-factor 20.85 dB  
Measured noise 18 dB   
Comment Example  
Sun flux is calculated by quadratic spline interpolation

Noise measurements Data Base

#	Date	Hour	Frequency ( Mhz )	Antenna Gain ( dBi )	Tsys ( K )	SFU ( Jy )	Expected Noise ( dB )	Measured Noise ( dB )	Delta ( dB )	Comments
259	01/02/2022	12:27:10	1303	35.062	36.980	872409	20.67	18.3	2.372	-78.1 210 65 s
260	02/02/2022	12:07:42	1303	35.062	36.980	891374	20.76	18.2	2.564	-78.1 210 65 s
261	03/02/2022	11:18:15	1303	35.062	36.980	909878	20.85	18.1	2.753	-78 210 65
262	03/02/2022	19:44:02	1303	35.062	36.980	909878	20.85	18	2.853	Example

Delete row  Delete All Data Hide main screen Close

Y-Factor noise

	Cassiopeia A	Cygnus A	Taurus A	Sagittarius A	Virgo A	3C273	Moon
Flux (Jy)	1947	1748	912	520	223	42	825
Noise Y-Factor (dB)	1.00	0.91	0.50	0.29	0.13	0.02	0.45

Moon distance (Km) 376686.4  
Moon age (days) 28.84  
Moon estimated surface temperature (K) 239.4

0 Days 7 Days 14 Days 21 Days 29.5 Days

NOTES  
Sagittarius A Flux for frequencies below 1 Ghz is affected from intrinsic strong variability and so actual Flux value may be different from calculated flux by a factor of 2 to 3  
Moon FLUX estimation is based on experimental algorithm

- **3C273 flux value is calculated by interpolation of data reported in :**  
*M. Türler, S. Paltani, T.J.-L. Courvoisier, et al., « 30 years of multi-wavelength observations of 3C273 », Astronomy & Astrophysics supplement series, 1999*
- **Cassiopeia A, Cygnus A, Taurus A, Virgo A flux values are calculated by interpolation of data reported in :**  
*J.W.M. Baars, P.G. Mezger, H.Wendker « The flux density values of standard sources used for antenna calibration », NRAO, Green Bank, West Virginia, 1964*  
*J.W.M. Baars et.al, Astron. & Astrophys. 61, 99-106, 1977*  
*W. Herrmann, [https://astropeiler.de/sites/default/files/Astropeiler\\_Story\\_2.pdf](https://astropeiler.de/sites/default/files/Astropeiler_Story_2.pdf)*
- **Moon flux value is calculated with a dedicated algorithm based on :**  
a) *J. Köppen, « Observation of the Moon », <https://portia.astrophysik.uni-kiel.de/~koeppen/10GHz/moon.html>*  
b) *D.Morabito, W.Imbriale, S.Keihm « Observing the moon at microwave frequencies using a large-diameter deep space network antenna », IEEE Transactions on antennas and propagation , 2008*
- **Sagittarius A flux values are calculated by interpolation of data reported in :**  
*S. Roy, P. Rao « Sgr A\* at low radio frequencies: Giant Metrewave Radio Telescope observations », Monthly Notices of the Royal Astronomical Society, 349, L25-L29, 1964*  
*G. C. Bower, S. Markoff et al. « Radio and Millimeter Monitoring of Sgr A\*: Spectrum, Variability, and Constraints on the G2 Encounter », The astronomical journal , Feb 2015*



# Murmur

## Pulsar mode

«PLAN Observation» visualizes all objects in the current internal data base with respective Azimuth/Elevation for the 24 hours ( from 00 to 23 ). For all the PSR the expected S/N will be listed . On the «Radio Horizon» sub-screen will be possible to set local radio horizon defining the minimum elevation in 30° steps

PLAN Observation

S/N calculated at 1303 Mhz Tracking valid fo for 10/21/2022 local time -1 day +1 day Tracking planner Drift scan planner

Object	Detection	S/N	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Moon						82:11	92:22	103:32	115:42	132:51	154:57	182:59	208:56	229:49	245:40	257:30	268:19	277:8								
Sun										109:4	120:14	133:23	147:30	164:35	182:36	200:34	216:29	230:21	242:12	253:2						
Cygnus-A		294:38	301:28	308:19	317:11	326:4						31:2	40:9	49:16	57:25	64:35	71:45	77:55	85:66	95:77	145:87	261:80	273:69	281:58	287:48	
Taurus-A		85:28	95:39	108:50	125:59	152:67	189:69	222:64	244:55	258:45	270:34	279:23	289:12	299:2												76:18
Cassiopeia		328:70	318:63	315:55	316:47	318:40	322:33	327:27	333:21	340:17	348:14	356:12	3:12	11:13	19:16	26:20	32:26	37:32	41:39	44:46	45:54	43:62	34:69	15:74	347:74	
Sagittarius-A															131:0	142:7	154:13	167:17	181:18	195:17	208:13	220:6				
3C273								92:5	102:16	114:26	128:36	145:43	165:48	188:49	209:45	227:38	242:29	254:19	265:8							
FRB 20220912A		297:72	296:62	298:52	302:43	308:34	314:26	321:18	329:12	338:7	347:3	357:2	7:2	16:4	25:8	34:14	42:21	48:28	54:37	59:46	63:56	65:66	61:75	27:84	311:81	
VIRGO A								84:12	94:23	105:33	119:44	137:52	161:58	189:59	215:55	235:47	250:37	262:27	272:16	282:5						
FRB 20201124A	FRB	86:35	96:46	109:57	130:66	165:73	209:71	238:63	256:53	268:42	278:31	287:21	296:10	306:1										58:5	68:15	77:25
B0833-45		1004								172:1	182:2	193:0														
B1641-45		299															171:0	181:1	191:0							
B0329+54	ok	280	52:61	47:69	29:76	349:78	320:73	309:65	307:57	309:48	312:40	317:32	323:25	330:19	337:14	345:10	354:8	3:8	11:9	20:12	27:16	34:22	41:29	46:36	50:44	52:53
J0437-4715		126				182:0																				
B0950+08	ok	71				94:15	105:26	117:37	133:46	154:52	178:55	203:53	224:47	241:38	254:28	265:17	275:6									
B0835-41		61						160:2	171:5	182:5	193:4	204:0														
B1749-28	ok	58													130:0	140:7	152:13	166:17	179:19	193:18	207:14	219:8	229:0			
B1933+16	ok	58	274:20	284:9											80:14	90:24	101:35	114:46	132:55	157:62	188:63	217:59	238:51	253:41	264:30	

time  
3 19:15:32 2022

Rev. History Help

RESET Settings and EXIT

Check for updates EXIT

Culminations Next 24h PSR visibility Next 24h PSR tracking

f-Factor 1 Month PSR visibility 1 Month PSR tracking

**SARS**  
Flow >0 : 714  
Flow >0 : 1902  
: 1.66

Minimum S/N > 10   
**S/N >10 suggested for reliable results**

Right AscensionJ2000 (RAJD) 53.25  deg  
 Declination (DECJD) 54.58  deg  
 Pulse with @ 50% of peak (W50) 6.6  msec. i  
 Barycentric period (P0) 0.71452  sec. i  
 Dispersion Measure (DM) 26.76  cm^-3 pc i  
 Flux @ 400 Mhz (S400) 1500.0  mJy i  
 Flux @1400 Mhz (S1400) 203.0  mJy i  
 Distance (Dist) 1.70  kpc 5528.4  ly i  
 Age (age) 5.53e+06  years i  
 Max Int. BW (no de-dispersion) 34  Mhz i  
 Expected S/N 4260.3  i  
 Azimuth 340.42  deg  
 Elevation 77.61  deg

**Detection details**

**Radio Horizon**

Azimuth

0	30	30	60	60	90	90	120	120	150	150	180	180	210	210	240	240	270	270	300	300	330	330	360	
0		0		10		0		0		0		0		0		0		0		0		0		0

Minimum. Elevation

Expected S/N calculated with parameters entered in the first screen . Hourly data indicate Azimuth and Elevation and are based on above radio horizon

Integration time 18000  sec.

Integration bandwidth 10000  kHz

The analysis does not take into account the polarization of the signal as this parameter is strongly depending on the specific Pulsar. Please evaluate carefully case by case as this may deteriorate performance up to 3dB.



# Murmur

## Pulsar mode

By positioning the cursor on any row under the «Detection» column it is possible to enter a 9 characters comment.

PLAN Observation

S/N calculated at 1303 Mhz Tracking valid fo for 10/21/2022 local time - 1 day + 1 day Tracking planner Drift scan planner

Object	Detection	S/N	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Moon							82:11	92:22	103:32	115:42	132:51	154:57	182:59	208:56	229:49	245:40	257:30	268:19	277:8							
Sun										109:4	120:14	133:23	147:30	164:35	182:36	200:34	216:29	230:21	242:12	253:2						
Cygnus-A		294:38	301:28	308:19	317:11	326:4						31:2	40:9	49:16	57:25	64:35	71:45	77:55	85:66	95:77	145:87	261:80	273:69	281:58	287:48	
Taurus-A		85:28	95:39	108:50	125:59	152:67	189:69	222:64	244:55	258:45	270:34	279:23	289:12	299:2											76:18	
Cassiopeia		328:70	318:63	315:55	316:47	318:40	322:33	327:27	333:21	340:17	348:14	356:12	3:12	11:13	19:16	26:20	32:26	37:32	41:39	44:46	45:54	43:62	34:69	15:74	347:74	
Sagittarius-A															131:0	142:7	154:13	167:17	181:18	195:17	208:13	220:6				
3C273								92:5	102:16	114:26	128:36	145:43	165:48	188:49	209:45	227:38	242:29	254:19	265:8							
FRB 20220912A		297:72	296:62	298:52	302:43	308:34	314:26	321:18	329:12	338:7	347:3	357:2	7:2	16:4	25:8	34:14	42:21	48:28	54:37	59:46	63:56	65:66	61:75	27:84	311:81	
VIRGO A								84:12	94:23	105:33	119:44	137:52	161:58	189:59	215:55	235:47	250:37	262:27	272:16	282:5						
FRB 20201124A	FRB	86:35	96:46	109:57	130:66	165:73	209:71	238:63	256:53	268:42	278:31	287:21	296:10	306:1									58:5	68:15	77:25	
B0833-45		1004							172:1	182:2	193:0															
B1641-45		299														171:0	181:1	191:0								
B0329+54	ok	280	52:61	47:69	29:76	349:78	320:73	309:65	307:57	309:48	312:40	317:32	323:25	330:19	337:14	345:10	354:8	3:8	11:9	20:12	27:16	34:22	41:29	46:36	50:44	52:53
J0437-4715		126				182:0																				
B0950+08	ok	71				94:15	105:26	117:37	133:46	154:52	178:55	203:53	224:47	241:38	254:28	265:17	275:6									
B0835-41		61						160:2	171:5	182:5	193:4	204:0														
B1749-28	ok	58													130:0	140:7	152:13	166:17	179:19	193:18	207:14	219:8	229:0			
B1933+16	ok	58	274:20	284:9											80:14	90:24	101:35	114:46	132:55	157:62	188:63	217:59	238:51	253:41	264:30	

Detection details

Record note

Delete all notes

Radio Horizon

Azimuth	0	30	60	90	120	150	180	210	240	270	300	330	360
Minimum. Elevation	0	0	10	0	0	0	0	0	0	0	0	0	0

Re-calculate

Save Horizon

Exit

Expected S/N calculated with parameters entered in the first screen . Hourly data indicate Azimuth and Elevation and are based on above radio horizon



# Murmur

## Pulsar mode

By selecting «Drift scan planner» on «Plan Observation» screen the future position (+10min., +20min., +30min., +40min., +60min. , +120min. ) of objects above the horizon will be visualized.

This function helps in positioning the antenna to perform a drift scan.

Object	+10min.(16:39:13)	+20min.(16:49:13)	+30min.(16:59:13)	+40min.(17:09:13)	+60min.(17:29:13)	+120min.(18:29:13)
Moon	283.63 : 01.44	285.25 : -00.31				
Sun	238.00 : 15.68	239.96 : 14.12	241.87 : 12.52	243.75 : 10.89	247.41 : 07.56	
Cygnus-A	081.91 : 62.26	083.15 : 64.08	084.44 : 65.90	085.79 : 67.72	088.75 : 71.38	104.46 : 82.29
Taurus-A						
Cassiopeia	040.07 : 36.50	040.72 : 37.69	041.35 : 38.89	041.93 : 40.11	042.98 : 42.58	044.96 : 50.23
Sagittarius-A	176.22 : 17.96	178.53 : 18.04	180.84 : 18.05	183.15 : 17.99	187.74 : 17.64	201.16 : 14.89
3C273	261.23 : 12.22	263.00 : 10.40	264.74 : 08.58	266.47 : 06.76	269.91 : 03.10	
FRB 20220912A	052.29 : 33.82	053.24 : 35.27	054.16 : 36.75	055.06 : 38.24	056.78 : 41.27	061.22 : 50.70
VIRGO A	268.82 : 19.55	270.54 : 17.72	272.24 : 15.89	273.92 : 14.06	277.27 : 10.42	287.37 : -00.30
FRB 20201124A						

The interface shows the 'Drift scan planner' tab selected. Below the table, there are buttons for 'Hide main screen' and 'Exit'. The 'Radio Horizon' section includes a table with columns for Azimuth (0, 30, 60, 90, 120, 150, 180, 210, 240, 270, 300, 330, 360) and Minimum Elevation (0, 0, 10, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0). A 'Re-calculate' button is present below the table. The text below the table reads: 'Expected S/N calculated with parameters entered in the first screen . Hourly data indicate Azimuth and Elevation and are based on above radio horizon'.

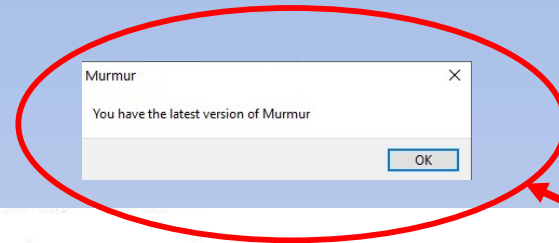




# Murmur

## Pulsar mode

«Check for updates» on main screen will check automatically if the installed version of Murmur is the latest one.



**Pulsar mode**

Location: Beviglie-Assisi    Latitude: 43.0938    Longitude: 12.5792    UTC Time: Sat Feb 5 18:02:49 2022    Local Time: Sat Feb 5 19:02:49 2022  
Current Time Zone Name : ora solare Europa occidentale (Not DST)

Rev. History    Help

RESET Settings and EXIT

Check for updates    EXIT

System evaluation mode    SAVE current set as default    CALCULATE

Pulsar mode    SET Observation location

TRACK noise sources    Culminations    Next 24h PSR visibility    Next 24h PSR tracking

CALCULATE Noise Y-Factor    1 Month PSR visibility    1 Month PSR tracking

Dish antenna     Other antenna

Dish diameter	5	m
Dish efficiency	69	%
Frequency	1303	Mhz
Line loss before LNA	0.1	dB
LNA Noise figure	0.23	dB
LNA gain	38	dB
Line loss after LNA	0.5	dB
Receiver noise figure	4	dB
T sky	4	K
T spillover	10	K
Integration time	18000	sec.
Integration bandwidth	56000	kHz

Wave length	0.23	m
Effective ant. aperture	13.5	m <sup>2</sup>
Dish area	19.63	m <sup>2</sup>
Far field	217	m
Antenna gain	35.06	dBi
HPBW	3.22	deg
System noise temp.	36.98	K
System noise figure	0.52	dB
G/T ratio	19.38	dB/K
Noise floor	-95.97	dBm
MDS	7.51	mJy

*The analysis does not take into account the polarization of the signal as this parameter is strongly depending on the specific Pulsar. Please evaluate carefully case by case as this may deteriorate performance up to 3dB.*

List of detectable PULSARS    Minimum S/N > 10

PULSARS extracted with S400 flow >0 : 714  
PULSARS extracted with S1400 flow >0 : 1902  
ATNF Pulsar catalogue Version : 1.66

Sorted by S/N

Above horizon

B0329+54	53.25	deg
B0950+08	54.58	deg
B2021+51	6.6	msec.
B2020+28	0.71452	sec.
B2016+28	26.76	cm <sup>-3</sup> pc
B0740-28	1500.0	mJy
B0355+54	203.0	mJy
B0628-28	1.70	kpc
B2154+40	5528.4	ly
B2111+46	5.53e+06	years
B0823+26	34	Mhz
B2310+42	280.0	
B0301+19		
B0919+06		
B0450+55		

Right Ascension(J2000 (RAJD)    53.25    deg

Declination (DECJD)    54.58    deg

Pulse with @ 50% of peak (W50)    6.6    msec.

Barycentric period (P0)    0.71452    sec.

Dispersion Measure (DM)    26.76    cm<sup>-3</sup> pc

Flux @ 400 Mhz (S400)    1500.0    mJy

Flux @1400 Mhz (S1400)    203.0    mJy

Distance (Dist)    1.70    kpc

Age (age)    5.53e+06    years

Max Int. BW (no de-dispersion)    34    Mhz

Expected S/N    280.0

Azimuth    343.48    deg

Elevation    77.88    deg

Show all PSR List

PLAN Observation

Select object to track



# Murmur

## Creating ATNF.csv file

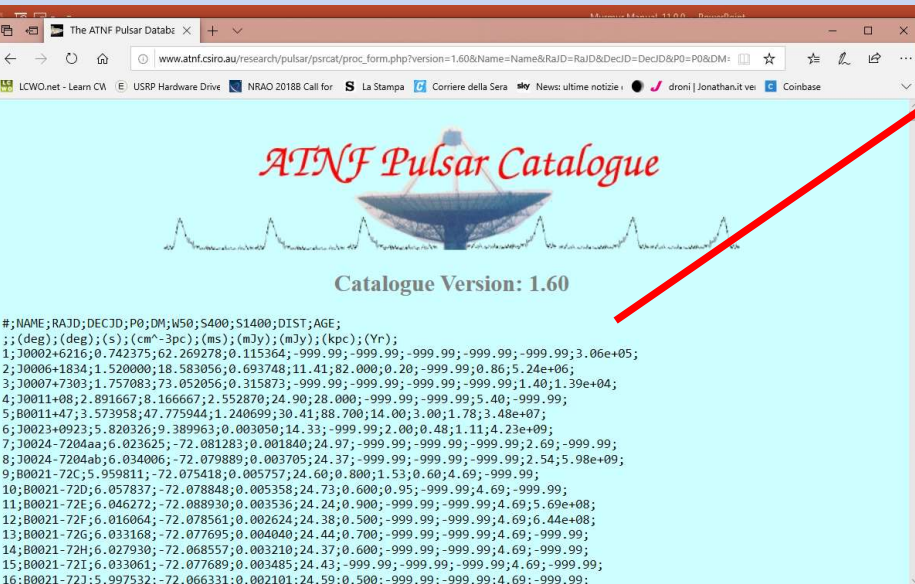
Starting from version 10.0.0 the installer of Murmur will also create in the C:\Murmur\Murmur directory the file ATNF.csv with Pulsars data downloaded from ATNF ( Australia Telescope National Facility ) Pulsar catalogue : <http://www.atnf.csiro.au/research/pulsar/psrcat/>.

The ATNF.csv file can also be created ( and edited ) from the user following this procedure :

Download the Pulsar data from ATNF catalogue using following http instruction ( copy and paste ):

[http://www.atnf.csiro.au/research/pulsar/psrcat/proc\\_form.php?version=2.5.1&Name=Name&RaJD=RaJD&DecJD=DecJD&P0=P0&DM=DM&W50=W50&S400=S400&S1400=S1400&Dist=Dist&Age=Age&startUserDefined=true&c1\\_val=&c2\\_val=&c3\\_val=&c4\\_val=&sort\\_attr=jname&sort\\_order=asc&condition=&pulsar\\_names=&ephemeris=short&coords\\_unit=raj%2Fdecj&radius=&coords\\_1=&coords\\_2=&style=Short+csv+without+errors&no\\_value=-999.99&fsize=3&x\\_axis=&x\\_scale=linear&y\\_axis=&y\\_scale=linear&state=query&table\\_bottom.x=87&table\\_bottom.y=35](http://www.atnf.csiro.au/research/pulsar/psrcat/proc_form.php?version=2.5.1&Name=Name&RaJD=RaJD&DecJD=DecJD&P0=P0&DM=DM&W50=W50&S400=S400&S1400=S1400&Dist=Dist&Age=Age&startUserDefined=true&c1_val=&c2_val=&c3_val=&c4_val=&sort_attr=jname&sort_order=asc&condition=&pulsar_names=&ephemeris=short&coords_unit=raj%2Fdecj&radius=&coords_1=&coords_2=&style=Short+csv+without+errors&no_value=-999.99&fsize=3&x_axis=&x_scale=linear&y_axis=&y_scale=linear&state=query&table_bottom.x=87&table_bottom.y=35)

**Be sure to put the required version !**



```
#; NAME; RAJD; DECJD; P0; DM; W50; S400; S1400; DIST; AGE;
; (deg); (deg); (s); (cm^3pc); (ms); (mJy); (mJy); (kpc); (Yr);
1; J0002+6216; 0.742375; 62.269278; 0.115364; -999.99; -999.99; -999.99; 3.06e+05;
2; J0006+1834; 1.520000; 18.583056; 0.693748; 11.41; 82.000; 0.20; -999.99; 0.86; 5.24e+06;
3; J0007+7303; 1.757083; 73.052056; 0.315873; -999.99; -999.99; -999.99; -999.99; 1.40; 1.39e+04;
4; J0011+08; 2.891667; 8.166667; 2.552870; 24.90; 28.000; -999.99; -999.99; 5.40; -999.99;
5; B0011+47; 3.573958; 47.775944; 1.240699; 30.41; 88.700; 14.00; 3.00; 1.78; 3.48e+07;
6; J0023+0923; 5.820326; 9.389963; 0.003050; 14.33; -999.99; 2.00; 0.48; 1.11; 4.23e+09;
7; J0024-7204aa; 6.023625; -72.081283; 0.001840; 24.97; -999.99; -999.99; -999.99; 2.69; -999.99;
8; J0024-7204ab; 6.034006; -72.079889; 0.003705; 24.37; -999.99; -999.99; -999.99; 2.54; 5.98e+09;
9; B0021-72c; 5.959811; -72.075418; 0.005757; 24.60; 0.800; 1.53; 0.60; 4.69; -999.99;
10; B0021-72d; 6.057837; -72.078848; 0.005358; 24.73; 0.600; 0.95; -999.99; 4.69; -999.99;
11; B0021-72e; 6.046272; -72.088930; 0.003536; 24.24; 0.900; -999.99; -999.99; 4.69; 5.69e+08;
12; B0021-72f; 6.016064; -72.078561; 0.002624; 24.38; 0.500; -999.99; -999.99; 4.69; 6.44e+08;
13; B0021-72g; 6.033168; -72.077695; 0.004040; 24.44; 0.700; -999.99; -999.99; 4.69; -999.99;
14; B0021-72h; 6.027930; -72.066557; 0.003210; 24.37; 0.600; -999.99; -999.99; 4.69; -999.99;
15; B0021-72i; 6.033061; -72.077689; 0.003485; 24.43; -999.99; -999.99; -999.99; 4.69; -999.99;
16; B0021-72j; 5.997532; -72.066331; 0.002101; 24.59; 0.500; -999.99; -999.99; 4.69; -999.99;
```

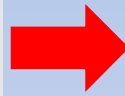
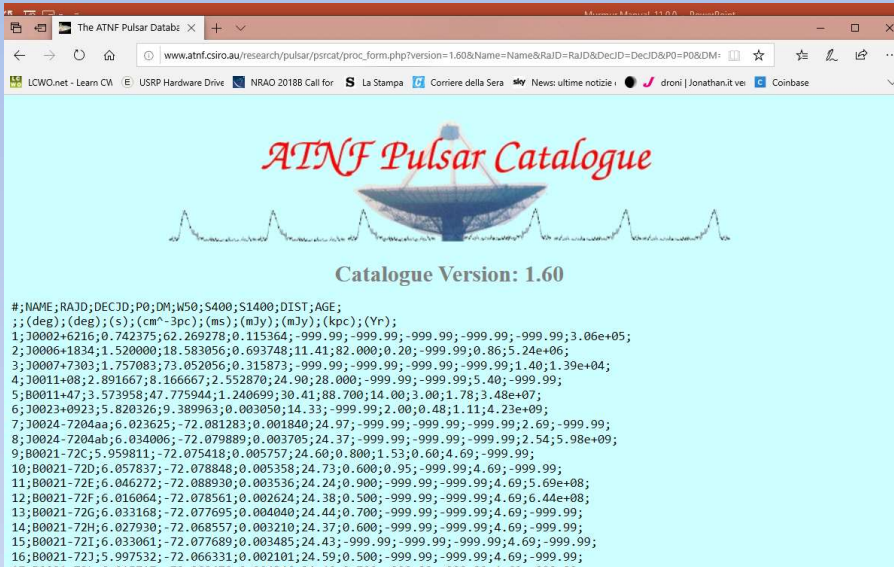
- Name: Pulsar name. The B name if exists, otherwise the J name.
  - RAJD: Right ascension (J2000) (degrees)
  - DecJD: Declination (J2000) (degrees)
  - P0: Barycentric period of the pulsar (s)
  - DM: Dispersion measure (cm-3 pc)
  - W50: Width of pulse at 50% of peak (ms).
  - S400: Mean flux density at 400 MHz (mJy)
  - S1400: Mean flux density at 1400 MHz (mJy)
  - Dist: Best estimate of the pulsar distance using the YMW16 DM-based distance as default (kpc)
  - Age: Spin down age (yr)
- Note : The value-999.999 indicates that the data is not available



# Murmur

## Creating ATNF.csv file

Select all data and save : ->File -> Save as ->ATNF.txt



```

Catalogue Version: 1.60
#;NAME;RAJD;DECJD;P0;DM;W50;S400;S1400;DIST;AGE;
;;(deg);(deg);(s);(cm^-3pc);(ms);(mJy);(mJy);(kpc);(Yr);
1;J0002+6216;0.742375;62.269278;0.115364;-999.99;-999.99;-999.99;-999.99;3.06e+05;
2;J0006+1834;1.520000;18.583056;0.693748;11.41;82.000;0.20;-999.99;0.86;5.24e+06;
3;J0007+7303;1.757083;73.052056;0.315873;-999.99;-999.99;-999.99;-999.99;1.40;1.39e+04;
4;J0011+08;2.891667;8.166667;2.552870;24.90;28.000;-999.99;-999.99;5.40;-999.99;
5;B0011+47;3.573958;47.775944;1.240699;30.41;88.700;14.00;3.00;1.78;3.48e+07;
6;J0023+0923;5.820326;9.389963;0.003050;14.33;-999.99;2.00;0.48;1.11;4.23e+09;
7;J0024-7204aa;6.023625;-72.081283;0.001840;24.97;-999.99;-999.99;-999.99;2.69;-999.99;
8;J0024-7204ab;6.034006;-72.079889;0.003705;24.37;-999.99;-999.99;-999.99;2.54;5.98e+09;
9;B0021-72C;5.959811;-72.075418;0.005757;24.60;0.800;1.53;0.60;4.69;-999.99;
10;B0021-72D;6.057837;-72.078848;0.005358;24.73;0.600;0.95;-999.99;4.69;-999.99;
11;B0021-72E;6.046272;-72.088930;0.003536;24.24;0.900;-999.99;-999.99;4.69;5.69e+08;
12;B0021-72F;6.016064;-72.078561;0.002624;24.38;0.500;-999.99;-999.99;4.69;6.44e+08;
13;B0021-72G;6.033168;-72.077695;0.004040;24.44;0.700;-999.99;-999.99;4.69;-999.99;
14;B0021-72H;6.027930;-72.068557;0.003210;24.37;0.600;-999.99;-999.99;4.69;-999.99;
15;B0021-72I;6.033061;-72.077689;0.003485;24.43;-999.99;-999.99;-999.99;4.69;-999.99;
16;B0021-72J;5.997532;-72.066331;0.002101;24.59;0.500;-999.99;-999.99;4.69;-999.99;
17;B0021-72L;6.015717;-72.082479;0.004346;24.40;0.700;-999.99;-999.99;4.69;-999.99;
18;B0021-72M;5.977041;-72.091877;0.003677;24.43;1.200;-999.99;-999.99;4.69;-999.99;
19;B0021-72N;6.038283;-72.074692;0.003054;24.57;-999.99;-999.99;-999.99;4.69;-999.99;
20;J0024-7204O;6.019386;-72.081602;0.002643;24.36;-999.99;-999.99;-999.99;4.69;1.38e+09;
21;J0024-7204P;6.083333;-72.069444;0.003643;24.29;-999.99;-999.99;-999.99;4.69;8.70e+07;
22;J0024-7204Q;6.068712;-72.073657;0.004033;24.27;-999.99;-999.99;-999.99;4.69;1.88e+09;
23;J0024-7204R;6.031605;-72.080665;0.003480;24.36;-999.99;-999.99;-999.99;4.69;3.72e+08;
24;J0024-7204S;6.016581;-72.078431;0.002830;24.38;-999.99;-999.99;-999.99;4.69;-999.99;
25;J0024-7204T;6.035621;-72.077481;0.007588;24.41;-999.99;-999.99;-999.99;4.69;4.09e+08;
26;J0024-7204U;6.040986;-72.066580;0.004343;24.34;-999.99;-999.99;-999.99;4.69;7.23e+08;
27;J0024-7204V;6.023625;-72.081283;0.001840;24.97;-999.99;-999.99;-999.99;2.69;-999.99;

```

**ATNF.csv must be as per above screenshot**  
**Note : fields must be semicolon delimited**

Open Microsoft Excel ( or equivalent ) and import data :

-> Data -> From text -> «ATNF.txt»-> Import ->Delimited->Start import at row-> 6

**(Please be sure that row 6 contains «Catalogue version»)**

-> Next->Tab, Semicolon->Next->General->Finish->OK

Save file : ->File->Save as -> «ATNF.csv» (with format csv (ms-dos) ) -> yes



# Murmur

## *General*

**Clicking on  buttons the program will show details and references on the specific parameter.**

**By clicking on «History» button you will be able to see all the program modifications from the first release.**

**The program works with «.» decimal sparators. In case of troubles with different OS settings please let me know.**

**Please report any problem / suggestion / correction to :  
[mario.natali@gmail.com](mailto:mario.natali@gmail.com)**

**«Murmur» can be downloaded from web site :  
<http://i0naa.altervista.org>**



# Murmur

## *Disclaimer*

**If you download and use this program means that you agree to following disclaimer :**

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