

*Version 8.0*

*Date: 6<sup>th</sup> April 2021*

# **Running Broadband RFI Filtering on GWB-IV**

*Kaushal D. Buch*

*Mekhala V. Muley*

# Running Real-time Broadband RFI Filtering on GWB-IV

The detailed procedure to run GWB-IV can be found in the latest document named “Operating procedure for running GWB-IV”.

## I. Settings for GWB

1. All the necessary settings as per the observation requirement have to be carried out from the main GWB-IV configuration window viz. *gwbcorr* GUI i.e. Preferred settings, GAC config, Pulsar Console etc. Enable RFI filtering and select the technique in the GWB main GUI (Refer Fig. 2)

2. Open the *gwbcorr* GUI, go to Tools and select *RFI FILTERING*. The following window will pop up as shown in Figure 1. This window should be opened as an independent window alongside of the main GUI.

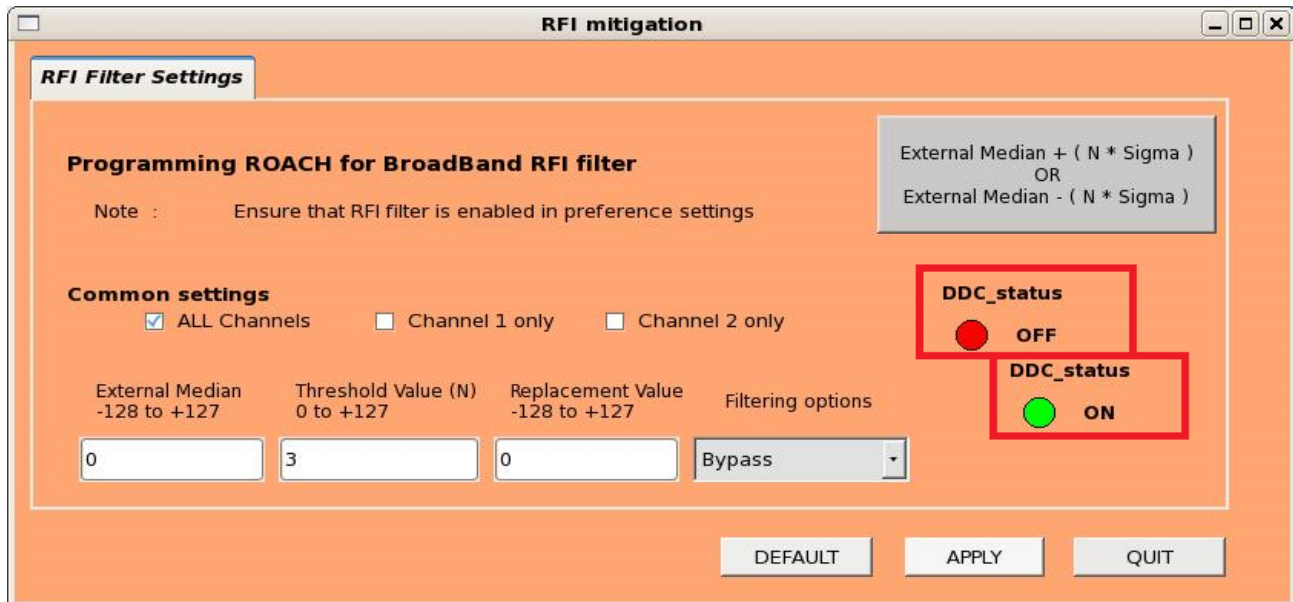


Fig. 1: RFI filtering GUI

**Note:** The parameters of the RFI filter can be applied on-the-fly while correlator is running however it would be recommended to use different scan or record file and keep the track of the applied settings.

3. RFI Filtering GUI options: The real-time broadband RFI Filtering in GWB-4 can be done using two detection techniques:

- i) MoM-based Voltage domain
- ii) MoM based Power domain

Both these techniques are available with wideband & narrowband (DDC) modes of the GWB.

Table 1 summarizes the various options and there recommended values:

Parameters	Data Type	Range	Default Value	<b>Recommended settings</b>
External Median (M)	Signed integer	-128 to +127	0	<b>0</b>
Threshold (N)	Fixed Point	0 to 255	3	<b>3 (Voltage detection) 9 (Power detection)</b>
Replacement Value (R)	Signed integer	-128 to +127	0	<b>0</b>
Filtering option (F)	Constant	<ol style="list-style-type: none"> <li>1. Bypass</li> <li>2. Constant (defined by R)</li> <li>3. Threshold clipping</li> <li>4. Digital Noise</li> </ol>	Bypass	<b>Digital noise</b>
Channel (Polarizations) Settings	--	<ol style="list-style-type: none"> <li>1. Both the channels</li> <li>2. Channel 1 only</li> <li>3. Channel 2 only</li> </ol>	Both the channels	Both the channels

Table 1: User configurable parameters for the RFI filter

**Note: Threshold clipping is not supported in Power domain selection**

5. Default parameters can be applied as shown below by pressing DEFAULT followed by APPLY button.

6. To change settings as per requirements, do necessary changes in the RFI filtering GUI and press APPLY button

**7. To make sure that the filter settings have been applied correctly, check the Matmon and Bandmon plots for 3 sigma threshold (voltage detection) or 9 sigma threshold (power detection), followed by 0 sigma, followed by the desired threshold. Snapshots of Matmon and Bandmon must be taken for all these settings (3 sigma and 0 sigma) and a copy should be emailed to [onlinerfi@ncra.tifr.res.in](mailto:onlinerfi@ncra.tifr.res.in) for all the observations using RFI filtering.**

8. To cancel this RFI Filtering GUI, press QUIT button. By closing and reopening the RFI Filtering GUI it stores the previously applied values in the rfi\_settings.hdr file.

### **Recommended settings:**

**1. System settings: Power equalization for the GWB must be between 80-90 counts.**

**2. RFI Filter settings: The external median must be 0, replacement value must be zero and the replacement option must be digital noise. The threshold factor must be 3 (voltage detection) and 9 (power detection).**

**Note:**

**(a) Operating the filter other than the settings described above may lead to sub-optimal filtering or over filtering.**

**(b) If the filter has to operate only in one channel (polarization) or any other setting/mode other than that described above then please contact Kaushal Buch ([kdbuch@gmrt.ncra.tifr.res.in](mailto:kdbuch@gmrt.ncra.tifr.res.in)), Sanjay Kudale ([ksanjay@gmrt.ncra.tifr.res.in](mailto:ksanjay@gmrt.ncra.tifr.res.in)) or Ajith Kumar ([ajit@ncra.tifr.res.in](mailto:ajit@ncra.tifr.res.in)) before planning the observation.**

## **II. Run the correlator**

1. Press the arrow button to start "gwb\_corr\_released.sh". (Refer point III for quick cross check of whether RFI filtering is applied properly or not).
2. Wait till gwb\_corr\_released.sh window prints "waiting for initialization....."
3. Press arrow button to start collect.sh.
4. On the online machine enter the command (i.e. shivneri/lenyadri):
  - a.) `[gwbcmd-gwb4*initndas]`
  - b.) Check gwb\_corr\_released.sh window to print the message "Correlator is ready for Set Cluster command"
  - c.) `[gwbcmd-gwb4*initprj]`
  - d.) Now, to start data acquisition from the GWB system, enter command:  
`[gwbcmd-gwb4*strndas]`
  - e.) For stopping the data acquisition from the GWB, enter the command:  
`[gwbcmd-gwb4*stpndas]`
  - f.) To halt the complete GWB system, enter command:  
`[gwbcmd-gwb4*hlndas]`

## **III Cross verifications to ensure that correct RFI options are getting applied**

1. The Configuration settings with RFI Filtering OFF and DDC mode OFF (is highlighted by red color rectangle) is shown in Figure.2
2. All the configuration settings and flags such as DDC, bits, BW and status of execution of python scripts etc. can be seen in gwb\_corr-released window. Following are the different settings which one can cross verify for 400MHz/ 200MHz /100MHz bandwidth of GWB.

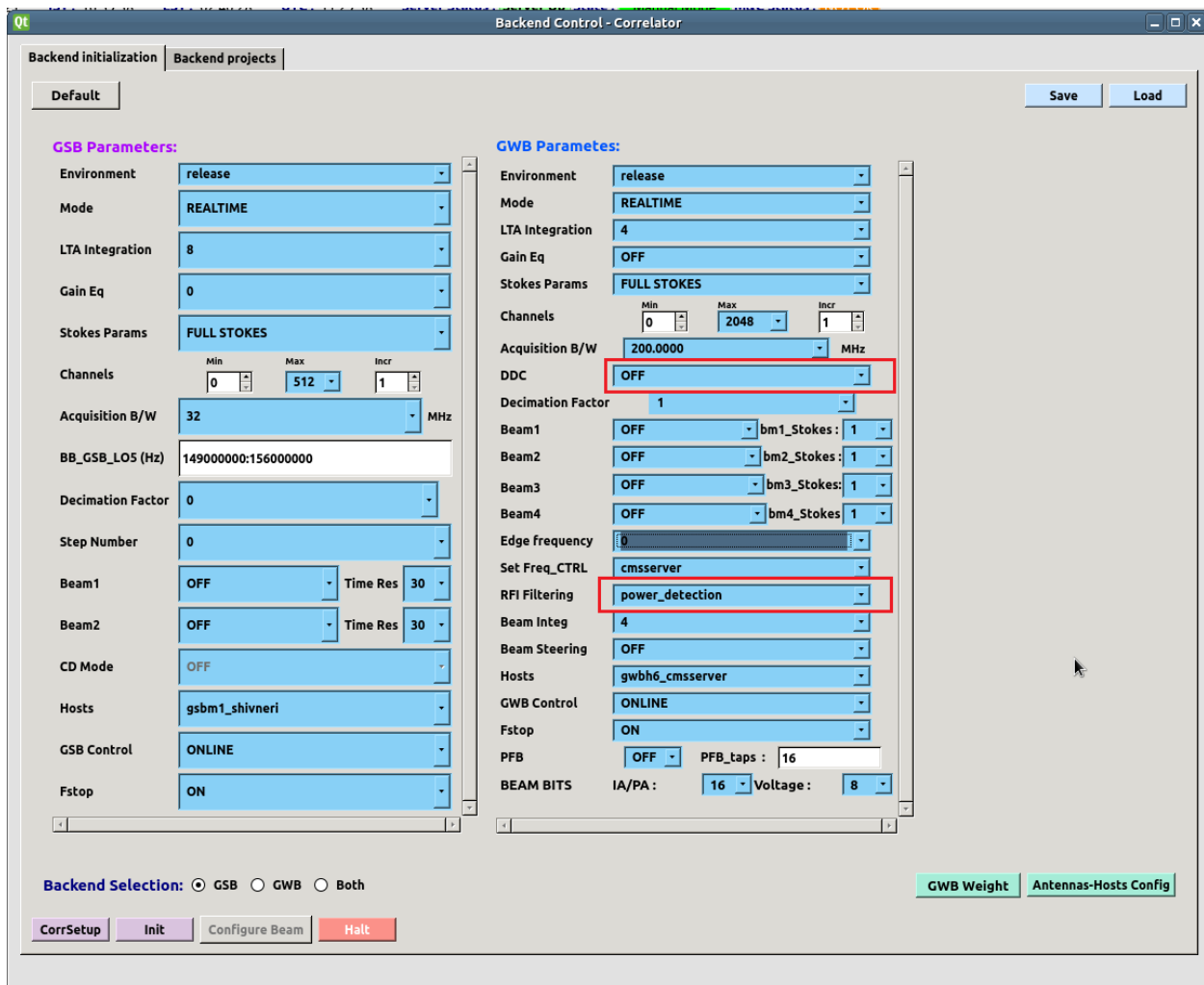


Fig. 2: GWB configuration GUI

## I. 200MHz bandwidth:

1. In case of running **GWB-IV without RFI Filtering** RFIFIL is 0 and the default python script (`gwb3_8bit_two_gbe_cluster.py`) is running for 200MHz Bandwidth (is highlighted by light green color rectangle in figure 3)
2. In case of running **GWB-IV with RFI Filtering (Voltage Detection)** RFIFIL is 1 and the python script (`dual_adc_rfi_mom_volage.py`) is running (is highlighted by light green color rectangle in figure 3)
3. In case of running **GWB-IV with RFI Filtering (Power Detection)**, RFIFIL is 2 and the python script (`dual_adc_rfi_mom_power.py`) is running (is highlighted by light green color rectangle in figure 3)

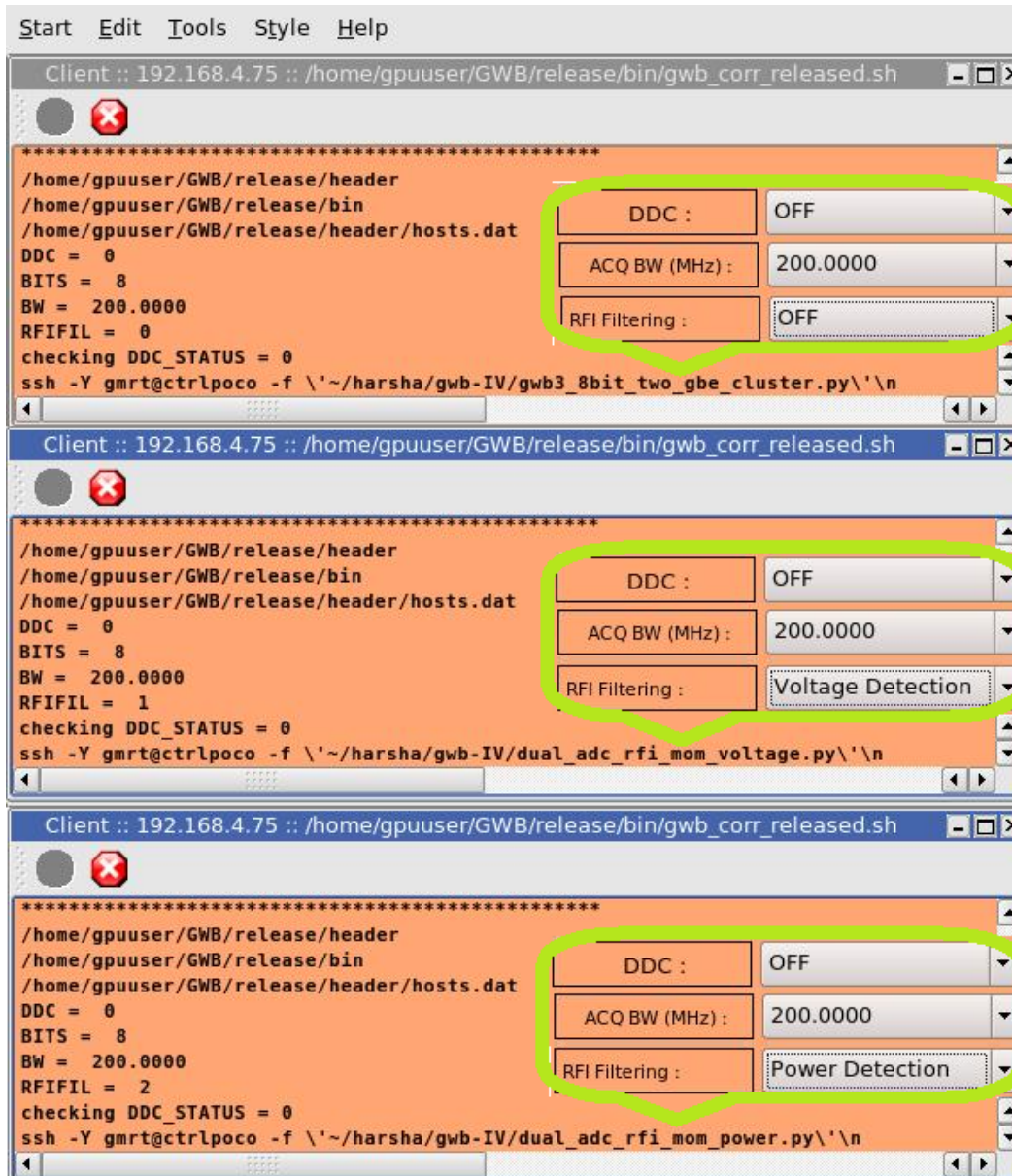


Fig. 3

## II. 400MHz bandwidth:

1. In case of running GWB-IV without RFI Filtering RFIFIL is 0 and the default python script (gwb3\_4bit\_two\_gbe\_cluster.py) is running for 400MHz Bandwidth. (is highlighted by light green color rectangle in figure 4)
2. In case of running GWB-IV with RFI Filtering (Voltage Detection) RFIFIL is 1 and the python script (dual\_adc\_rfi\_mom\_voltage\_4bit.py) is running (is highlighted by light green color rectangle in figure 4)
3. In case of running GWB-IV with RFI Filtering (Power Detection), RFIFIL is 2 and the python script (dual\_adc\_rfi\_mom\_power\_4bit.py) is running (is highlighted by light green color rectangle in figure 4)

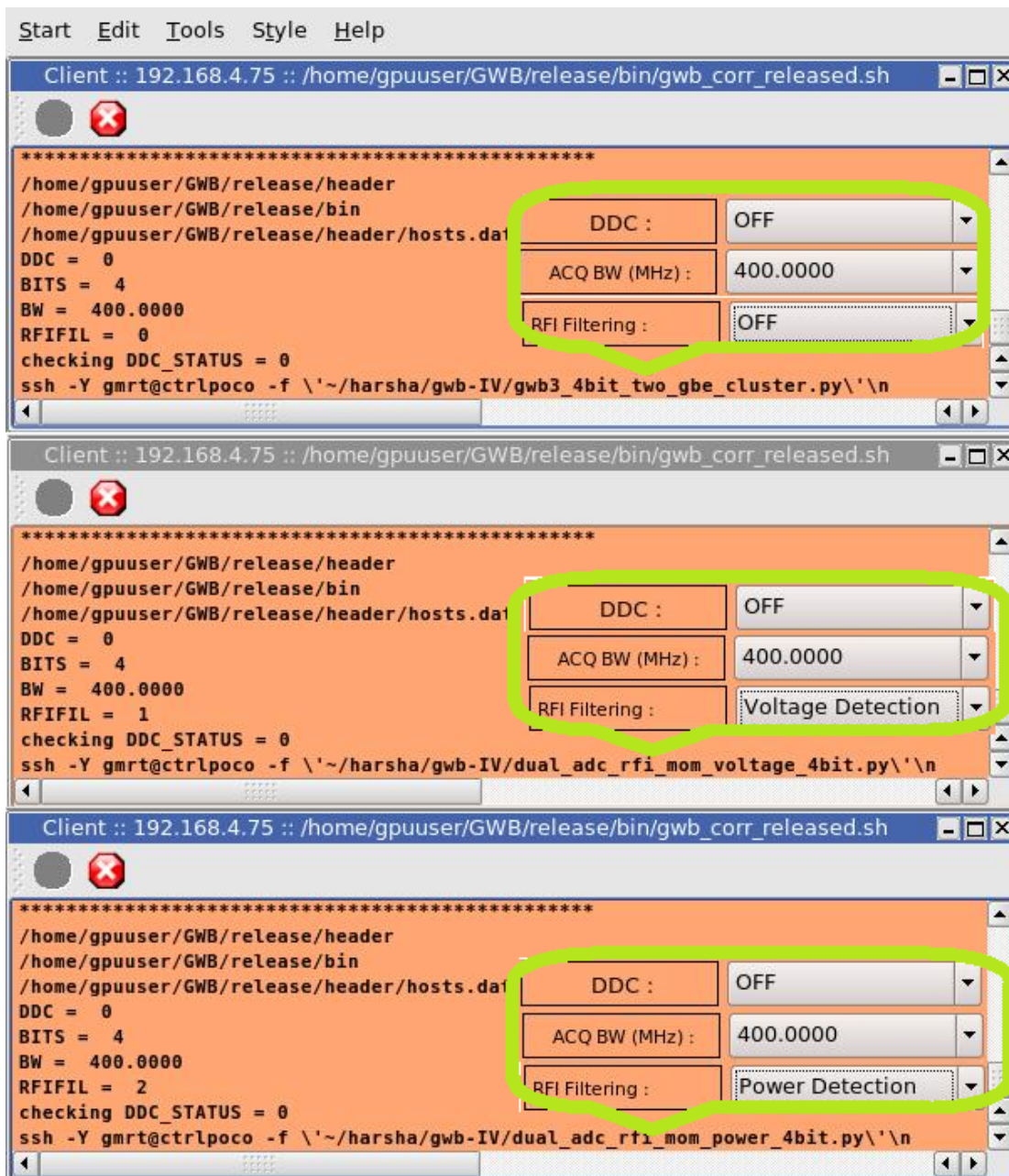


Fig. 4

### III. 100MHz bandwidth :

1. In case of running GWB-IV without RFI Filtering RFIFIL is 0 and the default python script (gwb3\_8bit\_two\_gbe\_cluster\_ddc.py) is running for 100MHz Bandwidth (DDC mode).
2. In case of running GWB-IV with RFI Filtering (Voltage Detection ) RFIFIL is 1 and the python script (dual\_adc\_rfi\_mom\_volage\_ddc.py) is running (is highlighted by light green color rectangle in figure 5)
3. In case of running GWB-IV with RFI Filtering (Power Detection), RFIFIL is 2 and the python script (dual\_adc\_rfi\_mom\_power\_ddc.py) is running (is highlighted by light green color rectangle in figure 5)

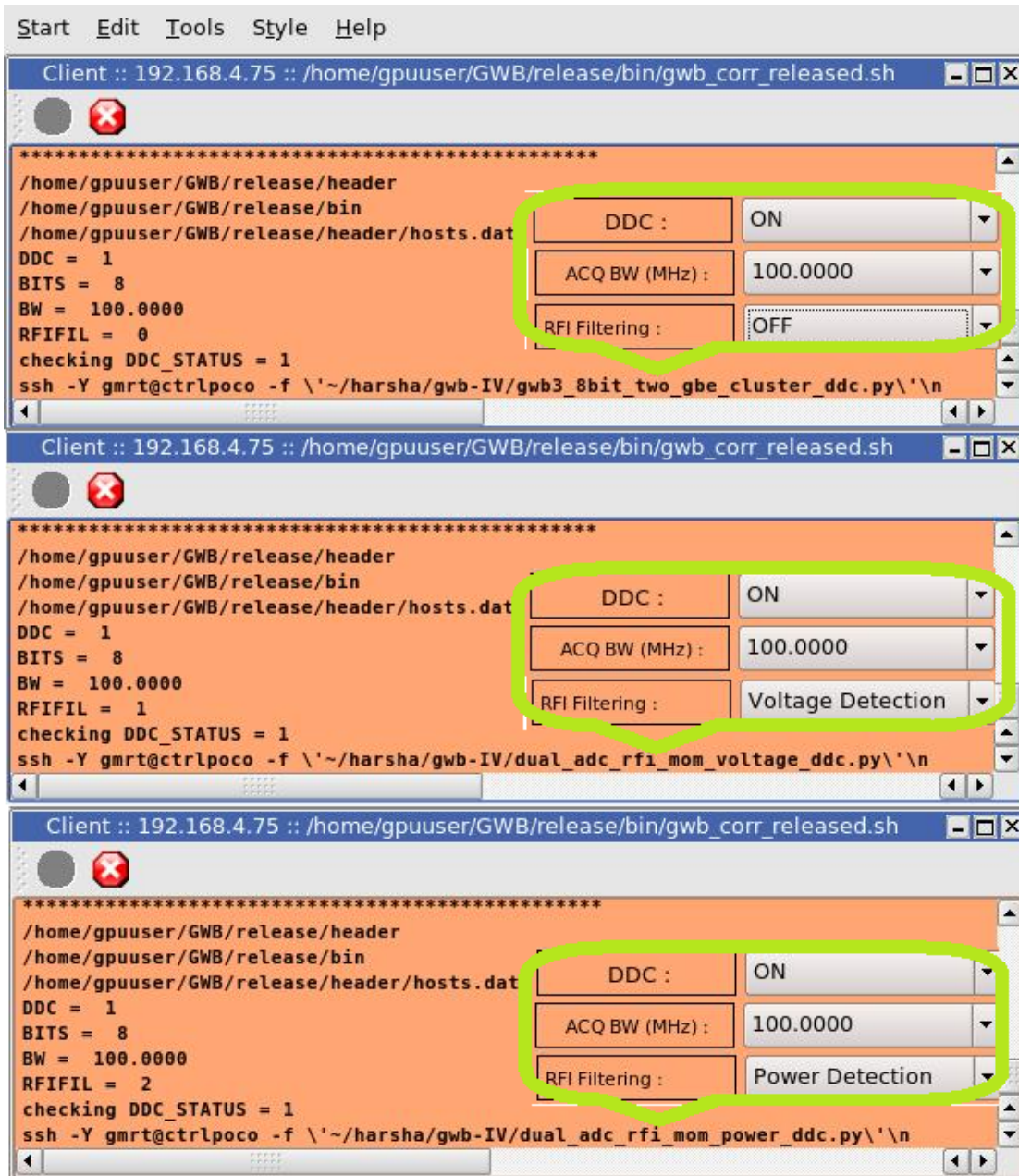


Fig. 5



### 3. The MatMon and BandMon is shown in figure 6 for RFI Filtering

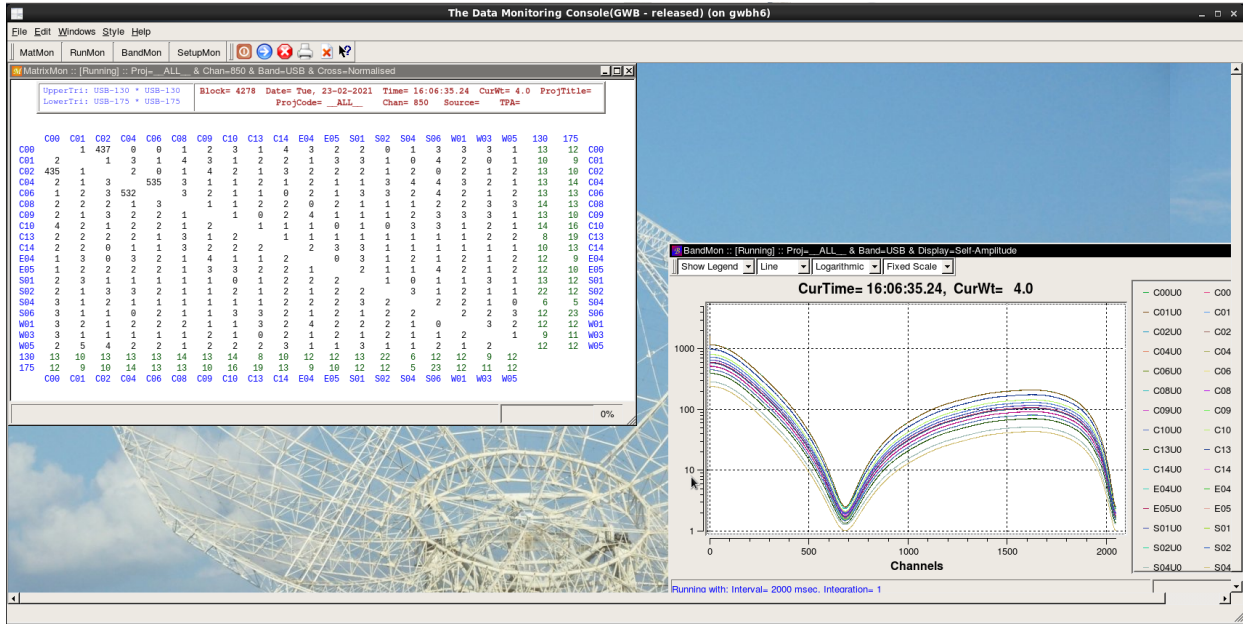


Fig. 6 After Applying 0 Sigma

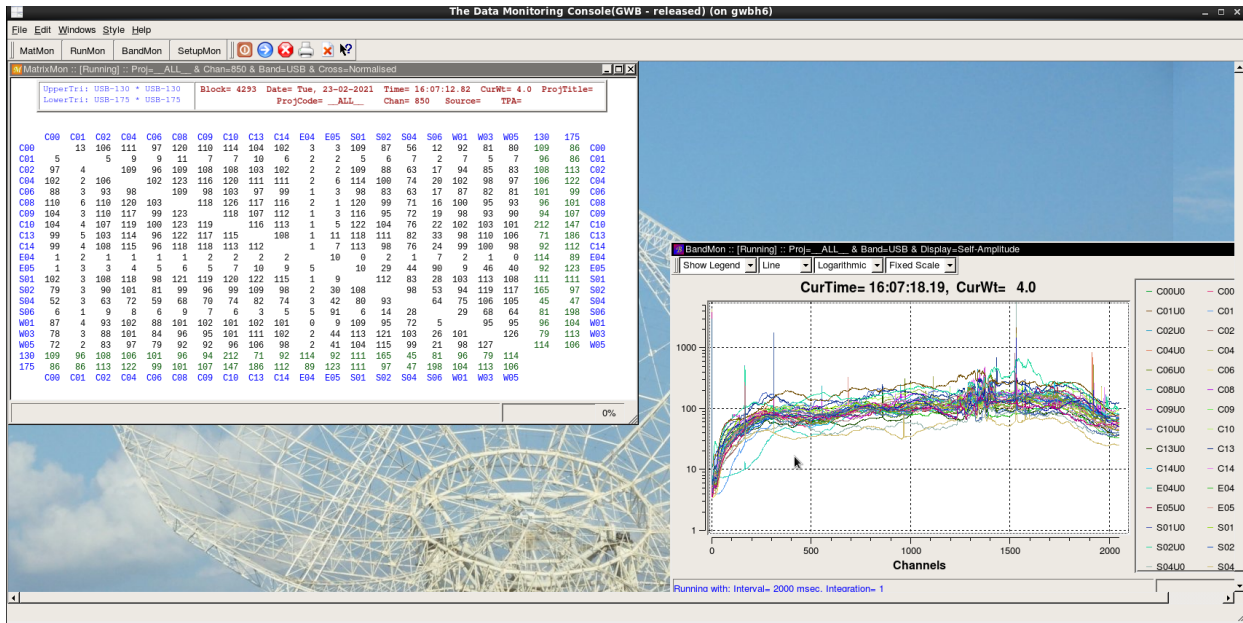


Fig. 7 After Applying 3 Sigma

**4. To check whether broadband RFI filtering is applied and running, just apply filtering and threshold as well as replacement with zero.**

**Steps for checking RFI filtering counter file during observations:**

Login to gmrt@ctrlpoco

Go to /home/gmrt/rfi\_scripts\_final/gwb3/counter\_scripts/counter\_log

Type ls -lthr to list all the counter files

The last file in the list would be the latest file and will have today's date  
i.e., rfi\_test\_05042021.csv

Type more <filename.csv> to view the contents

If one reset and hold command is executed, the latest file should be created in this location with counter values. In order to verify the functionality, execute one more set of reset and hold commands. The new counter values would be appended below the previous values.