***Version 2*** ***Date : 15th November 2018.***

# OPERATING PROCEDURE

# FOR

# RUNNING GWB - release

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# Available modes in GWB

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Input Bandwidth = 200/400MHz

No. of spectral channels = 2048/4096/8192/16384

Output time resolution = 0.671 / 1.34 / 2.68 / 5.36 / 10.73 / 21.4 seconds

No. of beams = 4

Interferometry modes = Total Intensity/Full Polar

Beamformer modes = IA/PA/Voltage

Narrowband mode possible BW = 100/50/25/12.5/6.25/3.125/1.5625 MHz

**Note : 1. Voltage beam mode is possible only in Total Intensity mode of Interferormeter.**
**2. PA beam full polar mode is available only in Full Polar mode of Interferometer.**

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**Note :Packet loss information is saved at the end of every observation at /home/gpuuser/GWB/log/loss_log.txt in gwbh6 machine along with timestamp. Example : loss_log_2018_03_26_12_10_AM.txt**

# Chapter 1: GWB Parameters

## 1.1 Available GWB config parameter selections and resultant values

| GWB Parameter | GUI Selection | Resultants in hdr file |
|---|---|---|
| MODE | REALTIME | 0 |
| LTA (for 200MHz/8-bit and 400MHz/4-bit modes) | 32 | 0.671088 * 32 = 21.474816 sec |
| | 16 | 0.671088 * 16 = 10.737408 sec |
| | 8 | 0.671088 * 8 = 5.368704 sec |
| | 4 | 0.671088 * 4 = 2.684352 sec |
| | 2 | 0.671088 * 2 = 1.342176 sec |
| | 1 | 0.671088 sec |
| LTA(for 100MHz Narrowband mode) | 32 | 1.342176 * 32 = 42.949632 |
| | 16 | 1.342176 * 16 = 21.474816 sec |
| | 8 | 1.342176 * 8 = 10.737408 sec |
| | 4 | 1.342176 * 4 = 5.368704 sec |
| | 2 | 1.342176 * 2 = 2.684352 sec |
| | 1 | 1.342176 sec |
| ACQ BW | 400 MHz | 400.0000 |
| | 200 MHz | 200.0000 |
| | 100 MHz | 100.0000 |
| DDC (see chapter 2.1.4) | 0 | Narrowbandmode OFF |
| | 1 | Narrowbandmode ON |
| Final BW (Decimation Factor) | 1 | 100MHz Final BW |
| | 2 | 50 MHz |
| | 4 | 25 MHz |
| | 8 | 12.5 MHz |
| | 16 | 6.25 MHz |
| | 32 | 3.125 MHz |
| | 64 | 1.5625 MHz |
| CHANNELS | 512 | 512 |
| | 1024 | 1024 |
| | 2048 | 2048 |
| | 4096 | 4096 |
| | 8192 | 8192 |
| | 16384 | 16384 |
| STOKES | 2 STOKES | 2 (Total Intensity mode) |
| | 4 STOKES | 4 (Full polar mode) |
| CONTROL | ONLINE | 1 |

| | | |
|---|---|---|
| TPA SELECTION | Online (tpa) | 1 |
| | Manual (GWB) | 0 |
| SIDEBAND FLAG | Flipped (LSB) | 1 |
| | Normal (USB) | -1 |
| GAB LO FREQUENCY | LO 130 & LO 175 | LO SET at GAB taken as RF for GWB. |
| GAIN | ON/OFF | 1/0 respectively. |
| FSTOP | ON/OFF | 1/0 respectively. |
| Beam – 1 / Beam – 2 / Beam – 3 / Beam - 4 | OFF/IA/PA/Voltage | 0/1/2/3 respectively |
| Beam Stokes | 1 Stokes/ 4 Stokes. | 1/4 respectively |
| Beam Integration | A range of values | **Appendix 1 and Appendix 2** |
| BITS | 8 | 8 (for ACQ BW <= 200 MHz) |
| | 4 | 4 (for ACQ BW > 200 MHz) |
| Beam Steering | OFF/ON | Edit file beam_str_src.list in gwbh6:/home/gpuuser/GWB/release/header for pointing beam2,beam3 and beam4 away from reference beam1 |

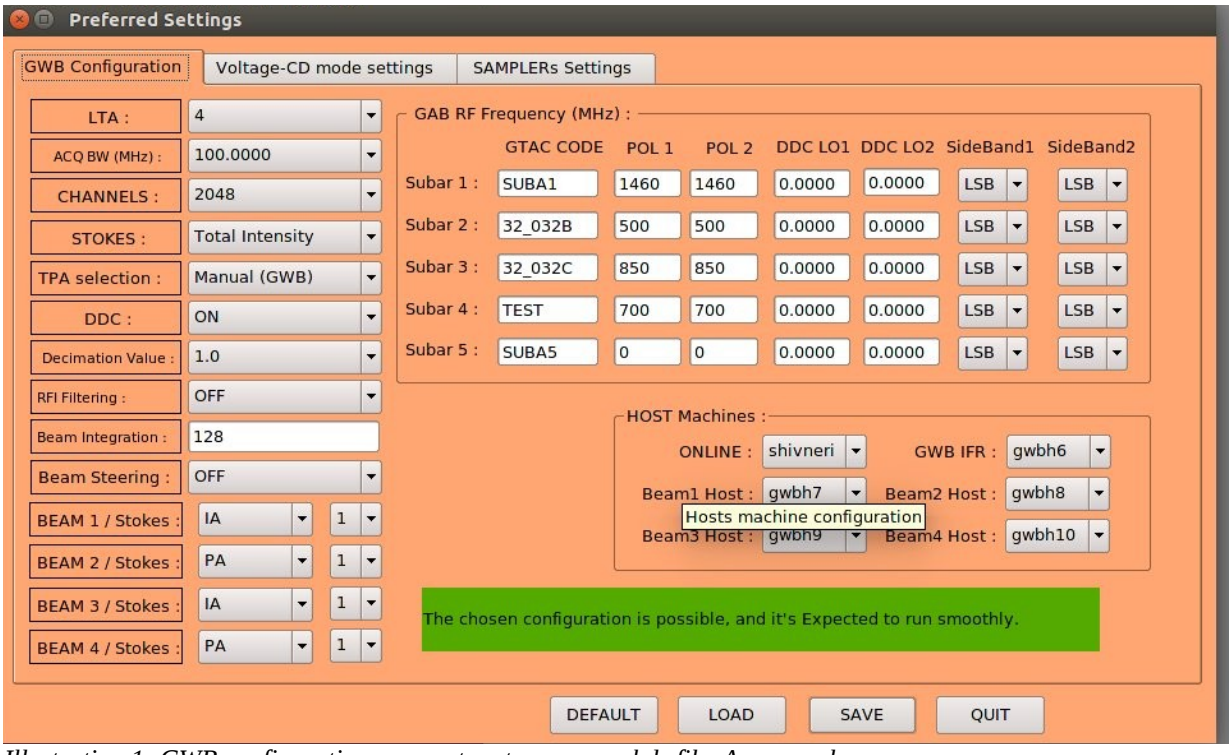


*Illustration 1: GWB configuration parameters to save gpu.hdr file. An example.*

# Chapter 2: Configuring and Running GWB

## 2.1 Configuring GWB

Log on to **observer@astro8** and enter commands as:

**cd ~/bin/gwb-release/**

**./gwbcorr**

This will open a qt interface for gwb release (gwb-dasconsole).

Go to Edit→Preferences (Ctrl + P) to pop up the settings window (see Illustration 1). The first tab in the window is GWB configuration window. The options in the window are described below :

| | | |
|---|---|---|
| LTA | : | Visibility data output time resolution |
| ACQ BW(MHz) | : | Acquisition BW 400/200/100 MHz |
| CHANNELS | : | No. of spectral channels |
| STOKES | : | Mode of interferometer. Total Intensity (2 Stokes) or Full Polar (4 stokes) |
| TPA selection | : | 1. Online (TPA) : This will take TPA parameters from online machine, and disables the Sideband Flag and GAB LO entries at GUI, for each relevant sub-array<br>2. Manual (GWB) : This enables user to choose sideband, and GAB LO Entries. |
| DDC | : | Narrowband mode ON/OFF |
| Decimation value | : | BW selection in Narrowband mode<br>1 – 100MHz, 2 – 50MHz, 4 – 25MHz, 8 – 12.5MHz, 16 – 6.25MHz, 32 – 3.125MHz, 64 – 1.5625MHz |
| RFI Filtering | : | RFI Filtering selection.<br>OFF – No RFI Filtering,<br>ON(MAD) – Median of Absolute Deviation based RFI Filtering<br>ON(MoM) – Median of MAD based RFI Filtering |
| BEAM 1/STOKES<br>BEAM 2/STOKES<br>BEAM 3/STOKES<br>BEAM 4/STOKES | : | Beam type selection and Beam Stokes selections |
| BEAM STEERING | : | Beam Steering OFF/ON |

Beam Integration: Sampling period of beam. See **Appendix 1 and 2.** Beam Integration is same for all beams.

In the same window, enter the GTAC code and RF settings for each sub-array. Sideband flags for each pol depends on the GAB LO and RF band of observation. LSB if RF < GAB LO and USB if RF > GAB LO.

After entering the configuration, press SAVE button at the bottom. On pressing SAVE, a message(highlighted in GREEN color) appears (see Illustration 1) whether the given configuration runs in real-time or not. If not, a warning message(highlighted in RED color) appears, that the given configuration does not run in real-time. Whether the configuration runs in real-time or not, depends on the total amount of IO required for the given configuration and IO budget. For details regarding IO budget and cost of IO for each setting (Interferometer and Beamformer), see **Appendix 3**.

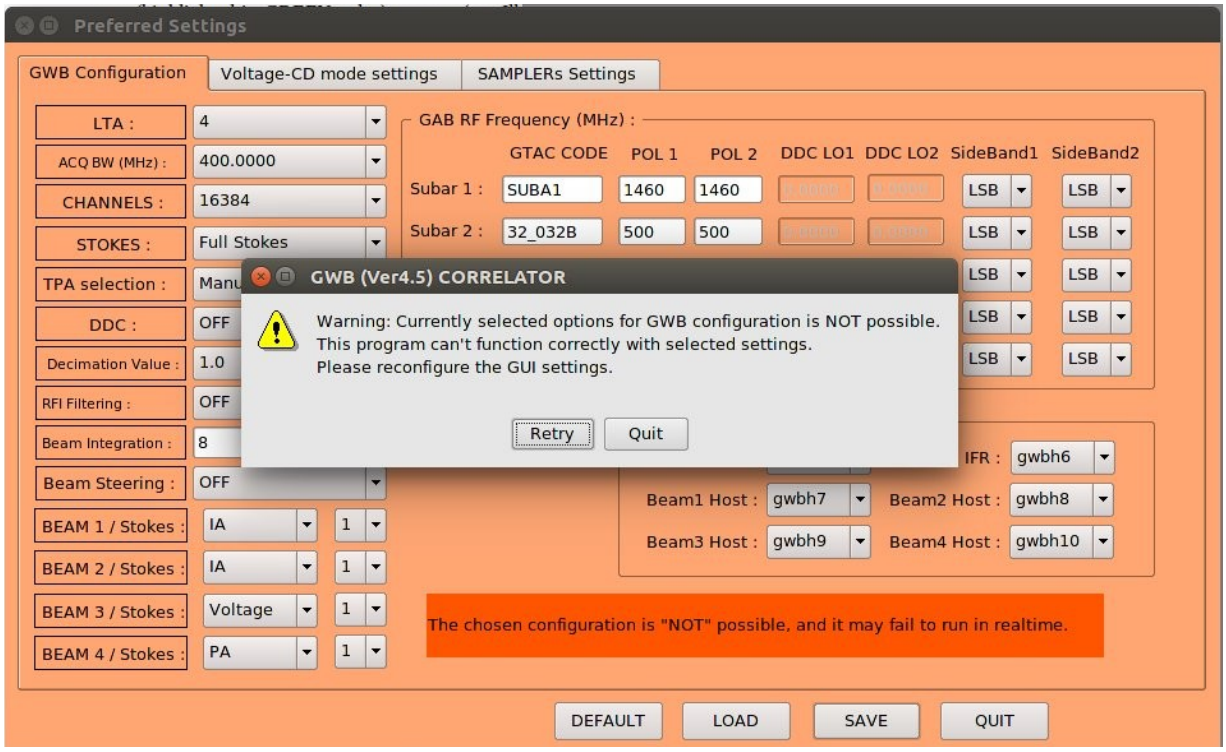


*Illustration 2: GWB configuration window with warning message showing the entered configuration does not run in real-time*

In case of **narrowband mode**, set DDC parameter ON and enter the decimation value depending on the BW required. Enter the values of DDC LO1 (pol 1) and DDC LO2 (pol 2). DDC LO value is the starting frequency of the narrowband. For example, if decimation is 4 and DDC LO is 50MHz, then the signal that can be seen is from 50MHz and 75MHz of the actual 100MHz BW baseband signal.

**Note : 1. Decimation is same for all the subarrays. There is no option for subarray specific decimation value.**

**2. DDC LO can be different for subarrays. Also, DDC LO can be different for each polarization.**

The possible decimation values, no. of taps used for filtering, actual BW and usable BW along with spectral channels and spectral resolution values given in **Appendix 4**.

## 2.2 Starting acquisition and recording

1. Go to the gwb-dasconsole
2. On Menubar go to "**Start -> Open All Windows"** or "**Ctrl+O"** or go to "**Start -> GWB - Windows -> Sockcmd "** to open all client processes to run gwb with sockcmd and online dassrv processes, or "**Start -> GWB - Windows -> Getcmd "** to run gwb without sockcmd and dassrv processes.

   This will popup the client workspaces for each command with following order:
   - "192.168.4.75**::gwb_corr_released.sh**":
     It can also be termed as acquisition client. This starts and broadcasts the acquisition processes to the compute nodes and host machines.
   - "192.168.4.75**::sockcmd.sh**": (can be started only when GWB running with sockcmd mode)
     This sets up the communication between online and correlator and gives acknowledgments to the commands from the correlator to the online and vice versa.
   - "192.168.4.75**::collect.sh**":
     This dumps the Astronomical data into the buffer and keeps it there for a while and removes it as per the FIFO logic.
   - "192.168.4.75**::record**":
     one can write the acquired data into specified lta format file as per requirement.

3. Now, click the **start button** (blue icon button) of first client window named "gwb_corr_released.sh" and wait till it shows the following message:

   ***gmrt_correlator : Waiting For Initialization Cmd ..***

4. Start sockcmd.sh, collect.sh, and dass-srv (from online machine) for gwb.

   ***ssh -X observer@shivneri***
   ***cd /odisk/online1/gsbe/dassrv-gpu/***
   ***./dassrv_released***

   This is also aliased as **`gwbdassrv`** on online machine (shivneri). In Case, if you are running GWB, in **"getcmd"** mode, then there is no need to start both sockcmd.sh and dassrv-gpu processes, user just have to start the process "collect" only.
5. Now click the **start button** (blue icon button) of "collect.sh" wondow
6. Enter initndas command from online user0.

```
allant;cmode 1;tpa(11)=15;initndas'/temp2/data/gsb.hdr' **(GWB ONLY).
allant;cmode 9;tpa(11)=15;initndas'/temp2/data/gsb.hdr' **(GSB + GWB).
```

For getcmd mode :

On the online machine terminal, enter command

**`gwbcmd-gwb4 initndas`**

`gwbcmd-gwb4` is the modified getcmd program, specially designed for acquiring

data for multi-sub-array observations.

After this command wait(nearly 15 to 20 seconds) for following messages in the first window.

Full Polar mode :

"collecting data for full polar mode
collecting data for full polar mode"

Total Intensity mode :

"collecting data for indian polar mode
collecting data for indian polar mode"

If beamformer is selected, timestamps information will be printed in between the above given messages.

7. Enter the command for initializing the Project for given subarray.

**allant;subar 4; prjtit '' ; prjobs ''; initprj(15,'TEST'); **(GWB ONLY).**
**allant;subar 4; prjtit '' ; prjobs ''; initprj(15,'TEST'); **(GSB + GWB).**

For getcmd mode :

On the online machine terminal, enter command

**gwbcmd-gwb4 initprj x (where x is subar # = 2,3,4,5 etc.**

**or**

**gwbcmd-gwb4 initprj ** This takes default subarray as subar 4**

8. Start and stop scan as per requirement and one can start record for the same.
To record the data in record window type in the format as :
GWBTST /gwbifrdata2/31mar/gwbtst_31mar2017.lta
GWBTST /gwbifrdata2/31mar/gwbtst_31mar2017.lta 4
For GWB with Sockcmd mode default commands strtndas and stpndas from online user / subar controller (command file) can be used.

**Recording (start and stop scans) using getcmd :**

**gwbcmd-gwb4 strtndas** *;for subar 4.*
**gwbcmd-gwb4 stpndas**
**gwbcmd-gwb4 strtndas <subar number>** *;for multi-sub-array observation.*
***gwbcmd-gwb4 stpndas <subar number>***

9. Starting **DASMON** :
login to gwbh6 : **ssh -X gpuuser@gwbh6**
enter commands as : **/home/gpuuser/GWB/release/bin/dasmon.pl**

Also, DasMon Can be Started from the main DasConsole GUI from

"**MenuBar->Tools->Interferometry->GWB DasMon" or *CTRL + M*** as an accelerator.

10. Starting Power Equalisation Program :
GWB Power Equalise GUI Can be Started from the main DasConsole GUI from "**MenuBar->Tools->Interferometry->GWB_PowerEq" or CTRL + E** as an accelerator.
This can also be done as explained in later section(2.3) 'GAB - GWB Power Equalise'.

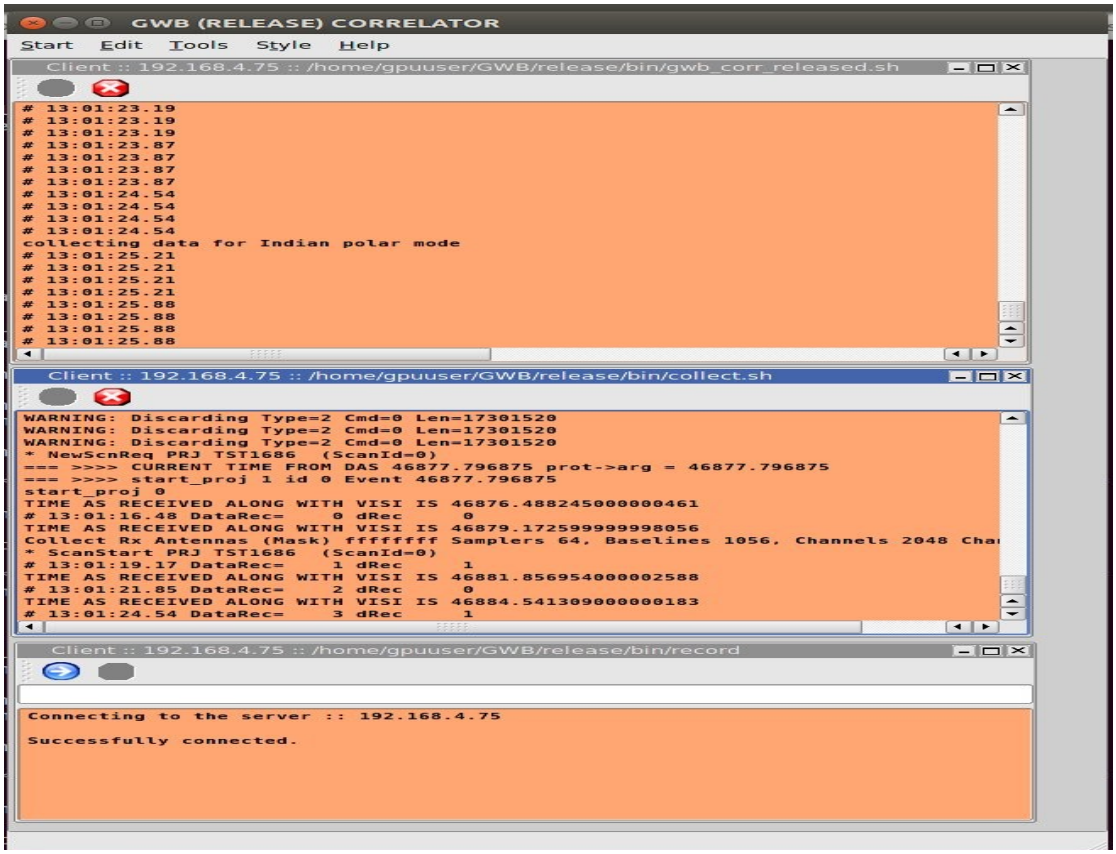

*Illustration 3: GWB data acquisition window*

## 2.3 GAB Power Equalise

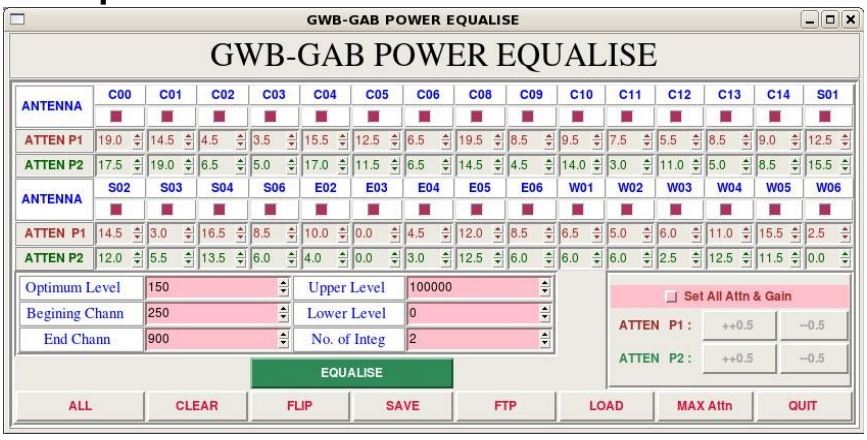

*Illustration 4: GWB-GAB power Equalise Window*

Power Equalise program is released for GWB, which uses the output self visibility data from GWB and equalizes the power levels at GAB (GMRT Analog Backend) system.

### Steps to follow (with GUI)

GWB Power Equalise GUI Can be Started from the main DasConsole GUI from "**MenuBar->Tools->GWB_PowerEq" or CTRL + E** as an accelerator (as explained earlier in GWB-CORRELATOR).

Also, The same can be started manually as follows:

1. Select the antennas connected to the GAB and GWB.
2. Initially make all GAB attenuation's same for both the polarization's, as set in the cdsetX file, or change Attenuation's to MAXIMUM, by clicking on button 'MAX Attn', apply it to GAB accordingly.
3. Set the Optimum level, Begining channel, End channel, Upper level, Lower level and Integrations as per requirement.
4. Click on the button save to generate text files as per selected gui options.
5. Click the button 'EQUALISE' to start first iteration.
6. Run the process 'run gwblev' from userX window from online(2-3 times).
7. Repeat steps 5 and 6 till optimum level is attained.

## 2.4 Running Phasing on GWB data :

This can be invoked from GWB-CORRELATOR Main Window from " **Tools -> Pulsar Tools -> GWB Phasing**", or pressing **Alt+P** as an accelerator.

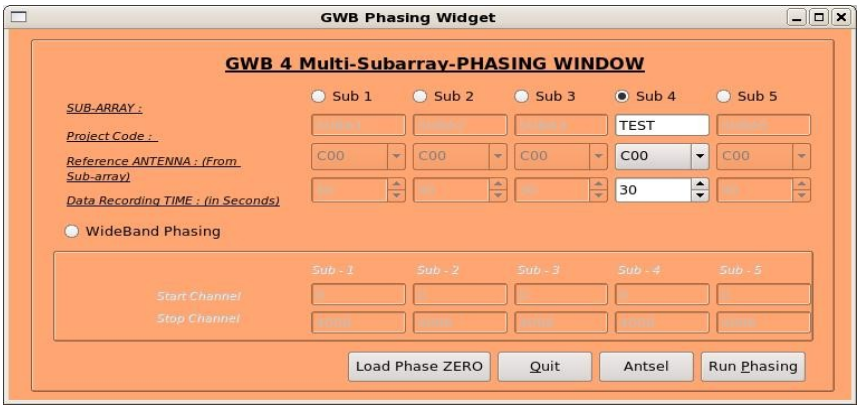


*Illustration 5: Phasing widget to run and apply phasing iteration on GWB.*

This utility temporarily provided with small tool which calls the phase_gwb.pl from online machine. Phasing Widget allows to choose the following :

- **Reference Antenna** Name for selected sub-array.
- **Sub-array** Number for which to carry phasing iteration.
- **Data recording Time** on which Phasing will work for the solutions.
- **Project Code** to be entered for related subarray which is used.

**Note** : Antenna selection Button is provided, but code for Antsel is not yet ready.

## 2.5 GAC selection:

GAC (GMRT Array Combiner) is the tool to configure the set of antennas into possible Beam configurations. In some way, this can be done as per the requirement of the user. This allows user to select and deselect the antennas for particular beam configuration.

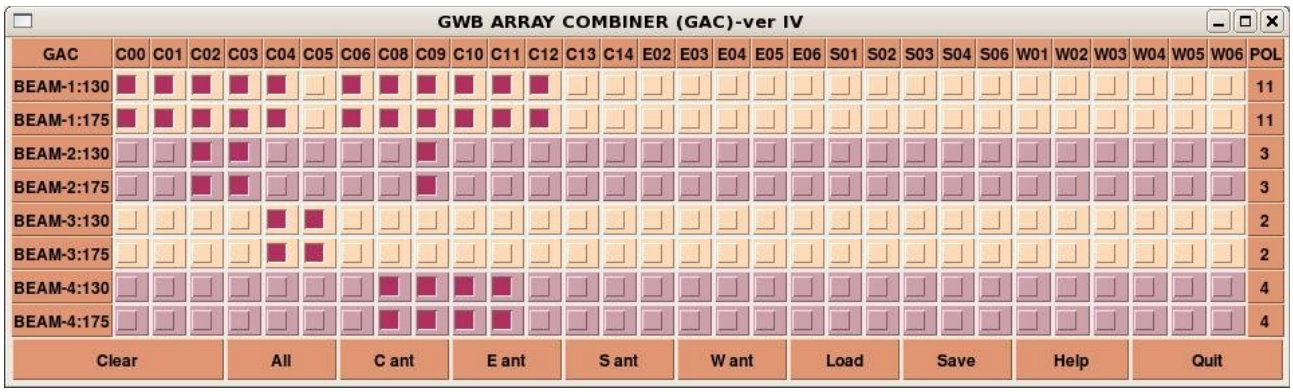


*Illustration 6: GAC showing antennas selected (marked in Red) for Beam data acquisition.*

## 2.6 Starting Pulsar Acquisition GUI :

1. This can be invoked from GWB-CORRELATOR Main Window from " **Tools** -> **Pulsar Tools** -> **Pulsar DasConsole**", or pressing **Alt+B** as an accelerator.
2. On Menubar go to "**Start** -> **All Windows"** or "**Ctrl+N"** or go to "**Start** -> **BEAM1** - **Windows** -> **All "** to open all client processes to run gwb pulsar mode processes on gwbh7.

   This will popup the client processing windows for Beam 1 host machine (set from the Preferences of the Main DasConsole GUI), in the following order :
   1. "**gwbh7::bm1_process_psr**":
      It can also be termed as incoherent array pulsar data acquisition and processing client.
   2. "**gwbh7::collect_psr**":
      This dumps the incoherent array pulsar data into the Shared memory.
   3. "**gwbh7::bm1_record_psr**":
      one can write the acquired incoherent pulsar data into specified .raw format file as per requirement.
3. Start the clients processes, **bm1_process_psr** and **collect_psr** by pressing Blue (start) button on the Client windows.
4. On the ToolBar There are Four Different Buttons viz., InitBm1, StartBm1, StopBm1, FinishBm1, etc.
5. On Menubar go to "**Start** -> **All Windows"** or "**Ctrl+N"** or go to "**Start** -> **BEAM2** - **Windows** -> **All "** to open all client processes to run gwb coherent array pulsar mode processes on gwbh8(gwbh8).

   In similar way, each beam client processes can be started.
6. In addition to this, there are Buttons to control data for pulsar beams which are named by InitAll, StartAll, StopAll, FinishAll. These four buttons will control the process simultaneously, If user is working with the all Beams data.

1. InitBm1/InitBm2/InitBm3/InitBm4/InitBoth :
   Initializes the beam Process Pulsar Beam Acquistion.
2. StartBm1/StartBm2/StartBm3/StartBm4/StartBoth :
   Starts the pulsar DATA acquisition for beam collect pulsar.
3. StopBm1/StopBm2/StopBm3/StopBm4/StopBoth :
   Stops the pulsar DATA acquisition for beam collect pulsar.
4. FinishBm1/FinishBm2/FinishBm3/FinishBm4/FinishBoth :
   Halts the beam Processes Pulsar Beam acquisition.


*Illustration 7: Pulsar Data acquisition Interface (Pulsar DAS).*

## 2.7 Multi-sub-array observations:

For this user has to split up the working antennas into two or more sub-arrays as per their requirement, and start the individual PROJECT from the ONLINE, for each of the sub-array. This works with both ONLINE and MANUAL TPA selection explained in section 3.6.

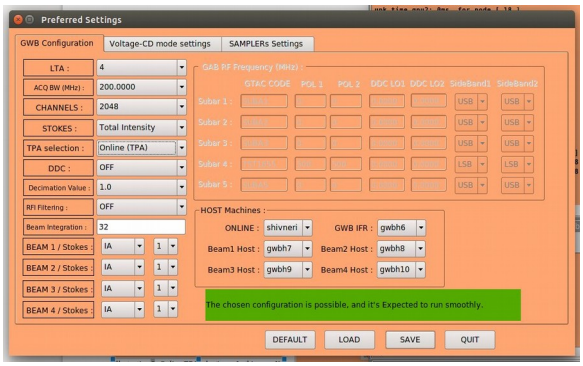


*Illustration 8: Online TPA selection – In this case No need to enter the values at GUI. ACQ straightaway reads the TPA parameters given at ONLINE for relevant sub-array. Irresepctive of the values of GAB RF/LO, GTAC CODE, SideBand FLAG etc. Here, user needs to confirm that TPA parameters and Frequency settings done at GAB, GWB are matching. If not then it may result in bad data.*

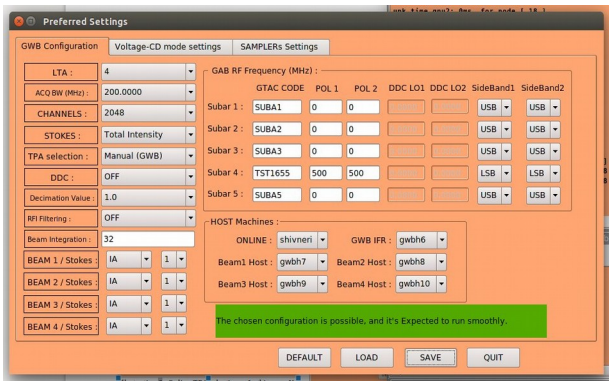


*Illustration 9: Manual TPA selection – for this user has to provide the PRJCODE entered at online for given particular sub-array, so that the GAB RF/LO Frequency entered at GUI for relevant sub-array will be taken calculation of TPA, along with selected SideBand FLAG. Otherwise, ACQ will consider the TPA values given at the ONLINE, which may be wrong considering the values set at GAB.*

## 2.8 TPA selection:

There are two ways in which TPA can be set for GWB, i.e. Online and Manual. As explained in Illustrations 8 and 9 above. For **Online TPA** user has to enter values as:

**tpa $(GABLO)_{p1}$ $(GABLO)_{p2}$ $(GABLO+70)_{p1}$ $(GABLO+70)_{p2}$ 70 70 ==> FOR LSB**
**tpa $(GABLO)_{p1}$ $(GABLO)_{p2}$ $(GABLO-70)_{p1}$ $(GABLO-70)_{p2}$ 70 70 ==> FOR USB**

In case of **Manual TPA** the tpa values will be calculated by GWB ACQ using GAB RF/LO values entered at relevant sub-arrays.

# Chapter 3: Troubleshooting

## Some Quick Checks

If acquisition program fails to run then check for the following :

1. Machines required to run gpu cluster are ON.
2. Check for the Processes DualAdcConfig and SetCluster are getting executed sucessfully, If not then **GWB ROACH-BOARDS may not be communicating / hanged / not in sync** with each other. Sometimes extension of this can be observed in acquisition program **"gwb_corr_released.sh"**
3. Check for the processes , shared memory segment which are not closed properly. According clear those processes and shared memory segments,using following commands on gwbh6
   a. */home/gpuuser/GWB/release/bin/clear_beam_shm.sh* // for shm
   b. */home/gpuuser/GWB/release/bin/kill_all_nodes.csh* // for orte-clean
4. Check for background mpi processes and clear the same.

## IMPORTANT Notes

i. GWB (GPU) can be run in parallel with GSB.
   1. Using above mentioned procedure. i.e. Using sockcmd.sh and dassrv-gpu processes.
   2. Using getcmd mode, while GSB is already running. No need to start sockcmd.sh and dassrv-gpu processes.
   3. Options to start client windows with sockcmd.sh and without sockcmd.sh are available in "Start->Gwb -Windows" options. And use gpucmd commands from online machine with arguments as initndas, initprj, strtndas, stpndas, etc.
   4. If no subar number is provided for gpucmd command then it will be executed for subar 4**.**

ii. Dasmon is released, and can be started with following command :
   ssh -X gpuuser@gwbh6 -f dasmon

## Antenna connections to GWB Roach boards

| Antenna (Pol) | GWB Node No. | |
|---|---|---|
| C00(pol1) | gwbcorr1 | ROACH 1 |
| C01(pol1) | gwbcorr1 | |
| C02(pol1) | gwbcorr1 | |
| C03(pol1) | gwbcorr1 | |
| C04(pol1) | gwbcorr2 | ROACH 2 |
| C05(pol1) | gwbcorr2 | |
| C06(pol1) | gwbcorr2 | |
| C08(pol1) | gwbcorr2 | |
| C09(pol1) | gwbcorr3 | ROACH 3 |
| C10(pol1) | gwbcorr3 | |
| C11(pol1) | gwbcorr3 | |
| C12(pol1) | gwbcorr3 | |
| C13(pol1) | gwbcorr4 | ROACH 4 |
| C14(pol1) | gwbcorr4 | |
| E02(pol1) | gwbcorr4 | |
| E03(pol1) | gwbcorr4 | |

| | | |
|---|---|---|
| E04(pol1) | gwbcorr9 | ROACH 5 |
| E05(pol1) | gwbcorr9 | |
| E06(pol1) | gwbcorr9 | |
| S01(pol1) | gwbcorr9 | |
| S02(pol1) | gwbcorr10 | ROACH 6 |
| S03(pol1) | gwbcorr10 | |
| S04(pol1) | gwbcorr10 | |
| S06(pol1) | gwbcorr10 | |
| W01(pol1) | gwbcorr11 | ROACH 7 |
| W02(pol1) | gwbcorr11 | |
| W03(pol1) | gwbcorr11 | |
| W04(pol1) | gwbcorr11 | |
| W05(pol1) | gwbcorr12 | ROACH 8 |
| W06(pol1) | gwbcorr12 | |
| C07(pol1) | gwbcorr12 | |
| S05(pol1) | gwbcorr12 | |
| | | |
| C00(pol2) | gwbcorr5 | ROACH 9 |
| C01(pol2) | gwbcorr5 | |
| C02(pol2) | gwbcorr5 | |
| C03(pol2) | gwbcorr5 | |
| C04(pol2) | gwbcorr6 | ROACH 10 |
| C05(pol2) | gwbcorr6 | |
| C06(pol2) | gwbcorr6 | |
| C08(pol2) | gwbcorr6 | |
| C09(pol2) | gwbcorr7 | ROACH 11 |
| C10(pol2) | gwbcorr7 | |
| C11(pol2) | gwbcorr7 | |
| C12(pol2) | gwbcorr7 | |
| C13(pol2) | gwbcorr8 | ROACH 12 |
| C14(pol2) | gwbcorr8 | |
| E02(pol2) | gwbcorr8 | |
| E03(pol2) | gwbcorr8 | |
| E04(pol2) | gwbcorr13 | ROACH 13 |
| E05(pol2) | gwbcorr13 | |
| E06(pol2) | gwbcorr13 | |
| S01(pol2) | gwbcorr13 | |
| S02(pol2) | gwbcorr14 | ROACH 14 |
| S03(pol2) | gwbcorr14 | |
| S04(pol2) | gwbcorr14 | |
| S06(pol2) | gwbcorr14 | |
| W01(pol2) | gwbcorr15 | ROACH 15 |
| W02(pol2) | gwbcorr15 | |
| W03(pol2) | gwbcorr15 | |
| W04(pol2) | gwbcorr15 | |
| W05(pol2) | gwbcorr16 | ROACH 16 |
| W06(pol2) | gwbcorr16 | |
| C07(pol2) | gwbcorr16 | |
| S05(pol2) | gwbcorr16 | |

## Settings on signal generator :

***800MHz frequency, +20 dbm power level, RF ON***

# Appendix - 1 BEAM INTEGRATION TABLE – for 200MHz 8-bit mode

This appendix gives the possible values for beam integration. The values are different for different no. of spectral channels. Below given are the values for both four stokes and single stokes. The corresponding sampling periods in milliseconds are also given

Note : All the values may not support pulsar das recording(writing beam data to disk)

Accurate Sampling period calculation :

Time(ms) = (No. of channels x 2 x No. of FFTs) / (400 x 10^3)

| Interferometer : Full Polar mode | | | | Interferometer : Total Intensity mode | | |
|---|---|---|---|---|---|---|
| Channels | Stokes | No. of FFTs | Time(ms) | Channels | No. of FFTs | Time(ms) |
| 16384 | 4 | 32(max) | 2.6 | 16384 | 32(max) | 2.6 |
| | | 16(min) | 1.3 | | 16 | 1.3 |
| | 1 | 32(max) | 2.6 | | 8 | 0.65 |
| | | 16 | 1.3 | | 4 | 0.32 |
| | | 8 | 0.65 | | 2(min) | 0.16 |
| | | 4(min) | 0.32 | 8192 | 64(max) | 2.6 |
| 8192 | 4 | 64(max) | 2.6 | | 32 | 1.3 |
| | | 32 | 1.3 | | 16 | 0.65 |
| | | 16(min) | 0.65 | | 8 | 0.32 |
| | 1 | 64(max) | 2.6 | | 4 | 0.16 |
| | | 32 | 1.3 | | 2(min) | 0.08 |
| | | 16 | 0.65 | 4096 | 256(max) | 5.2 |
| | | 8 | 0.32 | | 128 | 2.6 |
| | | 4(min) | 0.16 | | 64 | 1.3 |
| 4096 | 4 | 256(max) | 5.2 | | 32 | 0.65 |
| | | 128 | 2.6 | | 16 | 0.32 |
| | | 64 | 1.3 | | 8 | 0.16 |
| | | 32 | 0.65 | | 4 | 0.08 |
| | | 16(min) | 0.32 | | 2(min) | 0.04 |
| | 1 | 256(max) | 5.2 | 2048 | 256(max) | 2.6 |
| | | 128 | 2.6 | | 128 | 1.3 |
| | | 64 | 1.3 | | 64 | 0.65 |
| | | 32 | 0.65 | | 32 | 0.32 |
| | | 16 | 0.32 | | 16 | 0.16 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 8 | 0.16 | | 8 | 0.08 |
| | | 4(min) | 0.08 | | 4 | 0.04 |
| 2048 | 4 | 256(max) | 2.6 | | 2(min) | 0.02 |
| | | 128 | 1.3 | 1024 | 256(max) | 1.3 |
| | | 64 | 0.65 | | 128 | 0.65 |
| | | 32 | 0.32 | | 64 | 0.32 |
| | | 16(min) | 0.16 | | 32 | 0.16 |
| | 1 | 256(max) | 2.6 | | 16 | 0.08 |
| | | 128 | 1.3 | | 8 | 0.04 |
| | | 64 | 0.65 | | 4 | 0.02 |
| | | 32 | 0.32 | | 2(min) | 0.01 |
| | | 16 | 0.16 | | | |
| | | 8 | 0.08 | | | |
| | | 4(min) | 0.04 | | | |
| 1024 | 4 | 256(max) | 1.3 | | | |
| | | 128 | 0.65 | | | |
| | | 64 | 0.32 | | | |
| | | 32 | 0.16 | | | |
| | | 16(min) | 0.08 | | | |
| | 1 | 256(max) | 1.3 | | | |
| | | 128 | 0.65 | | | |
| | | 64 | 0.32 | | | |
| | | 32 | 0.16 | | | |
| | | 16 | 0.08 | | | |
| | | 8 | 0.04 | | | |
| | | 4(min) | 0.02 | | | |

# Appendix - 2 BEAM INTEGRATION TABLE – for 400MHz 4-bit mode

This appendix gives the possible values for beam integration for 400MHz 4-bit mode. The values are different for different no. of spectral channels. Below given are the values for both four stokes and single stokes. The corresponding sampling periods in milliseconds are also given

Note : All the values may not support pulsar das recording(writing beam data to disk)

Accurate Sampling period calculation :

Time(ms) = (No. of channels x 2 x No. of FFTs) / (800 x 10^3)

| Interferometer : Full Polar mode | | | | Interferometer : Total intensity mode | | |
|---|---|---|---|---|---|---|
| Channels | Stokes | No. of FFTs | Time(ms) | Channels | No. of FFTs | Time(ms) |
| 16384 | 4 | 32(min) | 1.3 | 16384 | 32(max) | 1.3 |
| | 1 | 32(max) | 1.3 | | 16 | 0.65 |
| | | 16 | 0.65 | | 8 | 0.32 |
| | | 8(min) | 0.32 | | 4(min) | 0.16 |
| 8192 | 4 | 64(max) | 1.3 | 8192 | 64(max) | 1.3 |
| | | 32(min) | 0.65 | | 32 | 0.65 |
| | 1 | 64(max) | 1.3 | | 16 | 0.32 |
| | | 32 | 0.65 | | 8 | 0.16 |
| | | 16 | 0.32 | | 4(min) | 0.08 |
| | | 8(min) | 0.16 | 4096 | 256(max) | 2.6 |
| 4096 | 4 | 256(max) | 2.6 | | 128 | 1.3 |
| | | 128 | 1.3 | | 64 | 0.65 |
| | | 64 | 0.65 | | 32 | 0.32 |
| | | 32(min) | 0.32 | | 16 | 0.16 |
| | 1 | 256(max) | 2.6 | | 8 | 0.08 |
| | | 128 | 1.3 | | 4(min) | 0.04 |
| | | 64 | 0.65 | 2048 | 256(max) | 1.3 |
| | | 32 | 0.32 | | 128 | 0.65 |
| | | 16 | 0.16 | | 64 | 0.32 |
| | | 8(min) | 0.08 | | 32 | 0.16 |
| 2048 | 4 | 256(max) | 1.3 | | 16 | 0.08 |
| | | 128 | 0.65 | | 8 | 0.04 |
| | | 64 | 0.32 | | 4(min) | 0.02 |
| | | 32(min) | 0.16 | 1024 | 256(max) | 0.65 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 256(max) | 1.3 | | 128 | 0.32 |
| | | 128 | 0.65 | | 64 | 0.16 |
| | | 64 | 0.32 | | 32 | 0.08 |
| | | 32 | 0.16 | | 16 | 0.04 |
| | | 16 | 0.08 | | 8 | 0.02 |
| | | 8(min) | 0.04 | | 4(min) | 0.01 |
| 1024 | 4 | 256(max) | 0.65 | | | |
| | | 128 | 0.32 | | | |
| | | 64 | 0.16 | | | |
| | | 32(min) | 0.08 | | | |
| | 1 | 256(max) | 0.65 | | | |
| | | 128 | 0.32 | | | |
| | | 64 | 0.16 | | | |
| | | 32 | 0.08 | | | |
| | | 16 | 0.04 | | | |
| | | 8(min) | 0.02 | | | |

# Appendix - 3 BEAM INTEGRATION TABLE – for 100MHz 8-bit mode

This appendix gives the possible values for beam integration. The values are different for different no. of spectral channels. Below given are the values for both four stokes and single stokes. The corresponding sampling periods in milliseconds are also given

Note : All the values may not support pulsar das recording(writing beam data to disk)

Accurate Sampling period calculation :

Time(ms) = (No. of channels x 2 x No. of FFTs) / (200 x 10^3)

| Interferometer : Full Polar mode | | | | Interferometer : Total Intensity mode | | |
|---|---|---|---|---|---|---|
| Channels | Stokes | No. of FFTs | Time(ms) | Channels | No. of FFTs | Time(ms) |
| 16384 | 4 | 32(max) | 5.3 | 16384 | 32(max) | 5.3 |
| | | 16(min) | 2.6 | | 16 | 2.6 |
| | 1 | 32(max) | 5.3 | | 8 | 1.3 |
| | | 16 | 2.6 | | 4 | 0.65 |
| | | 8 | 1.3 | | 2(min) | 0.32 |
| | | 4(min) | 0.65 | 8192 | 64(max) | 5.3 |
| 8192 | 4 | 64(max) | 5.3 | | 32 | 2.6 |
| | | 32 | 2.6 | | 16 | 1.3 |
| | | 16(min) | 1.3 | | 8 | 0.65 |
| | 1 | 64(max) | 5.3 | | 4 | 0.32 |
| | | 32 | 2.6 | | 2(min) | 0.16 |
| | | 16 | 1.3 | 4096 | 256(max) | 10.6 |
| | | 8 | 0.65 | | 128 | 5.3 |
| | | 4(min) | 0.32 | | 64 | 2.6 |
| 4096 | 4 | 256(max) | 10.6 | | 32 | 1.3 |
| | | 128 | 5.3 | | 16 | 0.65 |
| | | 64 | 2.6 | | 8 | 0.32 |
| | | 32 | 1.3 | | 4 | 0.16 |
| | | 16(min) | 0.65 | | 2(min) | 0.08 |
| | 1 | 256(max) | 10.6 | 2048 | 256(max) | 5.3 |
| | | 128 | 5.3 | | 128 | 2.6 |
| | | 64 | 2.6 | | 64 | 1.3 |
| | | 32 | 1.3 | | 32 | 0.65 |
| | | 16 | 0.65 | | 16 | 0.32 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 8 | 0.32 | | 8 | 0.16 |
| | | 4(min) | 0.16 | | 4 | 0.08 |
| 2048 | 4 | 256(max) | 2.6 | | 2(min) | 0.04 |
| | | 128 | 2.6 | 1024 | 256(max) | 2.6 |
| | | 64 | 1.3 | | 128 | 1.3 |
| | | 32 | 0.65 | | 64 | 0.65 |
| | | 16(min) | 0.32 | | 32 | 0.32 |
| | 1 | 256(max) | 5.3 | | 16 | 0.16 |
| | | 128 | 2.6 | | 8 | 0.08 |
| | | 64 | 1.3 | | 4 | 0.04 |
| | | 32 | 0.65 | | 2(min) | 0.02 |
| | | 16 | 0.32 | | | |
| | | 8 | 0.16 | | | |
| | | 4(min) | 0.08 | | | |
| 1024 | 4 | 256(max) | 2.6 | | | |
| | | 128 | 1.3 | | | |
| | | 64 | 0.65 | | | |
| | | 32 | 0.32 | | | |
| | | 16(min) | 0.16 | | | |
| | 1 | 256(max) | 2.6 | | | |
| | | 128 | 1.3 | | | |
| | | 64 | 0.65 | | | |
| | | 32 | 0.32 | | | |
| | | 16 | 0.16 | | | |
| | | 8 | 0.08 | | | |
| | | 4(min) | 0.04 | | | |

# Appendix – 4 IO budget, cost of Visibility IO and beam IO

## Total IO budget = 64

## Cost of visibility IO =

**(16 x channels x no. of stokes^2) / ( LTA * 2048 * 4 ) + 0.1**

**Cost of Beam IO (IA/PA) =**

**((0.5 x 128 x BW x BeamStokes ) / ( BeamIntegration * 200)) + 0.1**

**Note : BeamIntegration in No. of FFTS**

**Cost of Voltage Beam IO = (32 x BW / 200) + 0.1**

### 200MHz BW Total Intensity mode

Bandwidth = 200MHz
No. of stokes = 2 (Total Intensity)

| Channels | LTA | Visibility IO cost |
|---|---|---|
| 2048 | 1 | 16.1 |
| | 2 | 8.1 |
| | 4 | 4.1 |
| | 8 | 2.1 |
| | 16 | 1.1 |
| | 32 | 0.6 |
| 4096 | 1 | 32.1 |
| | 2 | 16.1 |
| | 4 | 8.1 |
| | 8 | 4.1 |
| | 16 | 2.1 |
| | 32 | 1.1 |
| 8192 | 1 | 64.1 |
| | 2 | 32.1 |
| | 4 | 16.1 |
| | 8 | 8.1 |
| | 16 | 4.1 |

| | | |
|---|---|---|
| | 32 | 2.1 |
| 16384 | 1 | 128.1 |
| | 2 | 64.1 |
| | 4 | 32.1 |
| | 8 | 16.1 |
| | 16 | 8.1 |
| | 32 | 4.1 |

cost of voltage beam IO = 32.1

Beamformer (IA or PA) IO cost

| **Channels** | **Integration in no. of FFTS** | **Integration in time (ms)** | **Beam IO cost** |
|---|---|---|---|
| 2048 | 128 | 1.31072 | 0.6 |
| | 64 | 0.65536 | 1.1 |
| | 32 | 0.32768 | 2.1 |
| | 16 | 0.16384 | 4.1 |
| | 8 | 0.08192 | 8.1 |
| | 4 | 0.04096 | 16.1 |
| 4096 | 128 | 2.62144 | 0.6 |
| | 64 | 1.31072 | 1.1 |
| | 32 | 0.65536 | 2.1 |
| | 16 | 0.32768 | 4.1 |
| | 8 | 0.16384 | 8.1 |
| | 4 | 0.08192 | 16.1 |
| 8192 | 64 | 2.62144 | 1.1 |
| | 32 | 1.31072 | 2.1 |
| | 16 | 0.65536 | 4.1 |
| | 8 | 0.32768 | 8.1 |
| | 4 | 0.16384 | 16.1 |
| 16384 | 32 | 2.62144 | 2.1 |
| | 16 | 1.31072 | 4.1 |
| | 8 | 0.65536 | 8.1 |

| | | | |
|---|---|---|---|
| | 4 | 0.32768 | 16.1 |

**400MHz BW Total Intensity mode**

Bandwidth = 400MHz
No. of stokes = 2 (Total Intensity)

| Channels | LTA | Visibility IO cost |
|---|---|---|
| 2048 | 1 | 16.1 |
| | 2 | 8.1 |
| | 4 | 4.1 |
| | 8 | 2.1 |
| | 16 | 1.1 |
| | 32 | 0.6 |
| 4096 | 1 | 32.1 |
| | 2 | 16.1 |
| | 4 | 8.1 |
| | 8 | 4.1 |
| | 16 | 2.1 |
| | 32 | 1.1 |
| 8192 | 1 | 64.1 |
| | 2 | 32.1 |
| | 4 | 16.1 |
| | 8 | 8.1 |
| | 16 | 4.1 |
| | 32 | 2.1 |
| 16384 | 1 | 128.1 |
| | 2 | 64.1 |
| | 4 | 32.1 |
| | 8 | 16.1 |
| | 16 | 8.1 |
| | 32 | 4.1 |

cost of voltage beam IO = 64.1

Beamformer (IA or PA) IO cost

| Channels | Integration in no. of FFTS | Integration in time (ms) | Beam IO cost |
|---|---|---|---|
| 2048 | 128 | 0.65536 | 1.1 |
| | 64 | 0.32768 | 2.1 |
| | 32 | 0.16384 | 4.1 |
| | 16 | 0.08192 | 8.1 |
| | 8 | 0.04096 | 16.1 |
| 4096 | 128 | 1.31072 | 1.1 |
| | 64 | 0.65536 | 2.1 |
| | 32 | 0.32768 | 4.1 |
| | 16 | 0.16384 | 8.1 |
| | 8 | 0.08192 | 16.1 |
| 8192 | 64 | 1.31072 | 2.1 |
| | 32 | 0.65536 | 4.1 |
| | 16 | 0.32768 | 8.1 |
| | 8 | 0.16384 | 16.1 |
| 16384 | 32 | 1.31072 | 4.1 |
| | 16 | 0.65536 | 8.1 |
| | 8 | 0.32768 | 16.1 |

## 200MHz BW Full Polar mode

Bandwidth = 200MHz
No. of stokes = 4 (Full Polar)

| Channels | LTA | Visibility IO cost |
|---|---|---|
| 2048 | 1 | 64.1 |
| | 2 | 32.1 |
| | 4 | 16.1 |
| | 8 | 8.1 |
| | 16 | 4.1 |
| | 32 | 2.1 |
| 4096 | 1 | 128.1 |
| | 2 | 64.1 |
| | 4 | 32.1 |
| | 8 | 16.1 |
| | 16 | 8.1 |
| | 32 | 4.1 |
| 8192 | 1 | 256.1 |
| | 2 | 128.1 |
| | 4 | 64.1 |
| | 8 | 32.1 |
| | 16 | 16.1 |
| | 32 | 8.1 |
| 16384 | 1 | 512.1 |
| | 2 | 256.1 |
| | 4 | 128.1 |
| | 8 | 64.1 |
| | 16 | 32.1 |
| | 32 | 16.1 |

No voltage beam in Full Polar mode.

IA or PA(Total Intensity)

| Channels | Integration in no. of FFTS | Integration in time (ms) | Beam IO cost |
|---|---|---|---|
| 2048 | 128 | 1.31072 | 0.6 |
| | 64 | 0.65536 | 1.1 |
| | 32 | 0.32768 | 2.1 |
| | 16 | 0.16384 | 4.1 |
| | 8 | 0.08192 | 8.1 |
| | 4 | 0.04096 | 16.1 |
| 4096 | 128 | 2.62144 | 0.6 |
| | 64 | 1.31072 | 1.1 |
| | 32 | 0.65536 | 2.1 |
| | 16 | 0.32768 | 4.1 |
| | 8 | 0.16384 | 8.1 |
| | 4 | 0.08192 | 16.1 |
| 8192 | 64 | 2.62144 | 1.1 |
| | 32 | 1.31072 | 2.1 |
| | 16 | 0.65536 | 4.1 |
| | 8 | 0.32768 | 8.1 |
| | 4 | 0.16384 | 16.1 |
| 16384 | 32 | 2.62144 | 2.1 |
| | 16 | 1.31072 | 4.1 |
| | 8 | 0.65536 | 8.1 |
| | 4 | 0.32768 | 16.1 |

PA (Full Polar) – 4 stokes

| Channels | Integration in no. of FFTS | Integration in time (ms) | Beam IO cost |
|---|---|---|---|
| | 128 | 1.31072 | 2.1 |
| | 64 | 0.65536 | 4.1 |
| | 32 | 0.32768 | 8.1 |

| | | | |
|---|---|---|---|
| 2048 | 16 | 0.16384 | 16.1 |
| 4096 | 128 | 2.62144 | 2.1 |
| | 64 | 1.31072 | 4.1 |
| | 32 | 0.65536 | 8.1 |
| | 16 | 0.32768 | 16.1 |
| 8192 | 64 | 2.62144 | 4.1 |
| | 32 | 1.31072 | 8.1 |
| | 16 | 0.65536 | 16.1 |
| 16384 | 32 | 2.62144 | 8.1 |
| | 16 | 1.31072 | 16.1 |

## 400MHz BW Full Polar mode

Bandwidth = 400MHz
No. of stokes = 4 (Full Polar)

| Channels | LTA | Visibility IO cost |
|---|---|---|
| 2048 | 1 | 64.1 |
| | 2 | 32.1 |
| | 4 | 16.1 |
| | 8 | 8.1 |
| | 16 | 4.1 |
| | 32 | 2.1 |
| 4096 | 1 | 128.1 |
| | 2 | 64.1 |
| | 4 | 32.1 |
| | 8 | 16.1 |
| | 16 | 8.1 |
| | 32 | 4.1 |
| 8192 | 1 | 256.1 |
| | 2 | 128.1 |
| | 4 | 64.1 |
| | 8 | 32.1 |
| | 16 | 16.1 |
| | 32 | 8.1 |
| 16384 | 1 | 512.1 |
| | 2 | 256.1 |
| | 4 | 128.1 |
| | 8 | 64.1 |
| | 16 | 32.1 |
| | 32 | 16.1 |

No voltage beam in Full Polar mode.

Beamformer IO cost :
IA or PA(Total Intensity)

| Channels | Integration in no. of FFTS | Integration in time (ms) | Beam IO cost |
|---|---|---|---|
| 2048 | 128 | 0.65536 | 1.1 |
| | 64 | 0.32768 | 2.1 |
| | 32 | 0.16384 | 4.1 |
| | 16 | 0.08192 | 8.1 |
| | 8 | 0.04096 | 16.1 |
| 4096 | 128 | 1.31072 | 1.1 |
| | 64 | 0.65536 | 2.1 |
| | 32 | 0.32768 | 4.1 |
| | 16 | 0.16384 | 8.1 |
| | 8 | 0.08192 | 16.1 |
| 8192 | 64 | 1.31072 | 2.1 |
| | 32 | 0.65536 | 4.1 |
| | 16 | 0.32768 | 8.1 |
| | 8 | 0.16384 | 16.1 |
| 16384 | 32 | 1.31072 | 4.1 |
| | 16 | 0.65536 | 8.1 |
| | 8 | 0.32768 | 16.1 |
| | 4 | 0.16384 | 32.1 |

PA (Full Polar) – 4 stokes

| Channels | Integration in no. of FFTS | Integration in time (ms) | Weigths |
|---|---|---|---|
| 2048 | 128 | 0.65536 | 4.1 |
| | 64 | 0.32768 | 8.1 |
| | 32 | 0.16384 | 16.1 |

| | | | |
|---|---|---|---|
| | 16 | 0.08192 | 32.1 |
| 4096 | 128 | 1.31072 | 4.1 |
| | 64 | 0.65536 | 8.1 |
| | 32 | 0.32768 | 16.1 |
| | 16 | 0.16384 | 32.1 |
| 8192 | 64 | 1.31072 | 8.1 |
| | 32 | 0.65536 | 16.1 |
| | 16 | 0.32768 | 32.1 |
| 16384 | 32 | 1.31072 | 16.1 |
| | 16 | 0.65536 | 32.1 |

# Appendix – 5 Narrowband mode

| Decimation | No. of taps | Actual BW(MHz) | Usable BW (% of actual BW around centre) | Spectral Channels | Resolution (kHz) |
|---|---|---|---|---|---|
| 1 | 64 | 100 | 100 | 2048, 4096, 8192, 16384 | 48.8, 24.4, 12.2, 6.1 |
| 2 | 64 | 50 | 98 | 2048, 4096, 8192, 16384 | 24.4, 12.2, 6.1, 3.05 |
| 4 | 64 | 25 | 97 | 2048, 4096, 8192, 16384 | 12.2, 6.1, 3.05, 1.52 |
| 8 | 128 | 12.5 | 97 | 2048, 4096, 8192, 16384 | 6.1, 3.05, 1.52, 0.76 |
| 16 | 128 | 6.25 | 96 | 2048, 4096, 8192, 16384 | 3.05, 1.52, 0.76, 0.38 |
| 32 | 128 | 3.125 | 75 | 2048, 4096, 8192, 16384 | 1.52, 0.76, 0.38, 0.19 |
| 64 | 256 | 1.5625 | 80 | 2048, 4096, 8192, 16384 | 0.76, 0.38, 0.19, 0.095 |

# Appendix – 6 Output data rates

**Visibility data rate**

No. of baselines = 930 (Total Intensity mode) and 1860 (Full Polar mode)

Total Intensity mode =

((212 + (No. of baselines x Channels / 2)) + (No. of baselines x Channels x 8)) / (LTA x 0.671) bytes per second

Full Polar mode = ((348 + (No. of baselines x Channels / 2)) + (No. of baselines x Channels x 8)) / (LTA x 0.671) bytes per second

Total Intensity mode :

| Channels | LTA | Visibility data rate (MB/s) |
|---|---|---|
| 2048 | 1 | 23 |
| | 2 | 11.5 |
| | 4 | 5.75 |
| | 8 | 2.87 |
| | 16 | 1.43 |
| | 32 | 0.72 |
| 4096 | 1 | 46 |
| | 2 | 23 |
| | 4 | 11.5 |
| | 8 | 5.75 |
| | 16 | 2.87 |
| | 32 | 1.43 |
| 8192 | 1 | 92 |
| | 2 | 46 |
| | 4 | 23 |
| | 8 | 11.5 |
| | 16 | 5.75 |
| | 32 | 2.87 |
| 16384 | 1 | 184 |
| | 2 | 92 |
| | 4 | 46 |
| | 8 | 23 |
| | 16 | 11.5 |
| | 32 | 5.75 |

Full Polar mode :

| Channels | LTA | Visibility data rate (MB/s) |
|---|---|---|
| 2048 | 1 | 46 |
| | 2 | 23 |
| | 4 | 11.5 |
| | 8 | 5.75 |
| | 16 | 2.87 |
| | 32 | 1.43 |
| 4096 | 1 | 92 |
| | 2 | 46 |
| | 4 | 23 |
| | 8 | 11.5 |
| | 16 | 5.75 |
| | 32 | 2.87 |
| 8192 | 1 | 184 |
| | 2 | 92 |
| | 4 | 46 |
| | 8 | 23 |
| | 16 | 11.5 |
| | 32 | 5.75 |
| 16384 | 1 | 368 |
| | 2 | 184 |
| | 4 | 92 |
| | 8 | 46 |
| | 16 | 23 |
| | 32 | 11.5 |

**Beam data rate =**
**(2 x Bandwidth x No. of Stokes) / (Beam Integration in FFTs) bytes per second**
**200MHz Total Intensity mode(Interferometer) IA/PA and Full Polar mode(Interferometer) IA/PA (PA Total Intensity mode)**

| Channels | Integration in no. of FFTS | Integration in time (ms) | Beam data rate (MB/s) |
|---|---|---|---|
| 2048 | 128 | 0.65536 | 3.125 |
| | 64 | 0.32768 | 6.25 |
| | 32 | 0.16384 | 12.5 |
| | 16 | 0.08192 | 25 |
| | 8 | 0.04096 | 50 |

| | | | |
|---|---|---|---|
| 4096 | 128 | 1.31072 | 3.125 |
| | 64 | 0.65536 | 6.25 |
| | 32 | 0.32768 | 12.5 |
| | 16 | 0.16384 | 25 |
| | 8 | 0.08192 | 50 |
| 8192 | 64 | 1.31072 | 6.25 |
| | 32 | 0.65536 | 12.5 |
| | 16 | 0.32768 | 25 |
| | 8 | 0.16384 | 50 |
| 16384 | 32 | 1.31072 | 12.5 |
| | 16 | 0.65536 | 25 |
| | 8 | 0.32768 | 50 |

**400MHz Total Intensity mode(Interferometer) IA/PA and Full Polar mode(Interferometer) IA/PA (PA Total Intensity mode)**

| Channels | Integration in no. of FFTS | Integration in time (ms) | Beam data rate (MB/s) |
|---|---|---|---|
| 2048 | 128 | 0.65536 | 6.25 |
| | 64 | 0.32768 | 12.5 |
| | 32 | 0.16384 | 25 |
| | 16 | 0.08192 | 50 |
| | 8 | 0.04096 | 100 |
| 4096 | 128 | 1.31072 | 6.25 |
| | 64 | 0.65536 | 12.5 |
| | 32 | 0.32768 | 25 |
| | 16 | 0.16384 | 50 |
| | 8 | 0.08192 | 100 |
| 8192 | 64 | 1.31072 | 12.5 |
| | 32 | 0.65536 | 25 |
| | 16 | 0.32768 | 50 |
| | 8 | 0.16384 | 100 |
| 16384 | 32 | 1.31072 | 25 |
| | 16 | 0.65536 | 50 |
| | 8 | 0.32768 | 100 |

**200MHz Full Polar mode(Interferometer) PA (PA Full Polar mode)**

| Channels | Integration in no. of FFTS | Integration in time (ms) | Beam data rate (MB/s) |
|---|---|---|---|
| 2048 | 128 | 1.31072 | 12.5 |
| | 64 | 0.65536 | 25 |
| | 32 | 0.32768 | 50 |
| | 16 | 0.16384 | 100 |
| 4096 | 128 | 2.62144 | 12.5 |
| | 64 | 1.31072 | 25 |
| | 32 | 0.65536 | 50 |
| | 16 | 0.32768 | 100 |
| 8192 | 64 | 2.62144 | 25 |
| | 32 | 1.31072 | 50 |
| | 16 | 0.65536 | 100 |
| 16384 | 32 | 2.62144 | 50 |
| | 16 | 1.31072 | 100 |

**400MHz Full Polar mode(Interferometer) PA (PA Full Polar mode)**

| Channels | Integration in no. of FFTS | Integration in time (ms) | Beam data rate (MB/s) |
|---|---|---|---|
| 2048 | 128 | 0.65536 | 25 |
| | 64 | 0.32768 | 50 |
| | 32 | 0.16384 | 100 |
| | 16 | 0.08192 | 200 |
| | 8 | 0.04096 | 400 |
| 4096 | 128 | 1.31072 | 25 |
| | 64 | 0.65536 | 50 |
| | 32 | 0.32768 | 100 |
| | 16 | 0.16384 | 200 |
| | 8 | 0.08192 | 400 |
| 8192 | 64 | 1.31072 | 50 |
| | 32 | 0.65536 | 100 |
| | 16 | 0.32768 | 200 |
| | 8 | 0.16384 | 400 |

| | | | |
|---|---|---|---|
| 16384 | 32 | 1.31072 | 100 |
| | 16 | 0.65536 | 200 |
| | 8 | 0.32768 | 400 |
| | 4 | 0.16384 | 800 |

# Appendix - 7 POWER ON/OFF PROCEDURE

## 1. Switch OFF procedure

a. Switch off the ROACH UNITS in the racks by holding down the Black switch on the front panel for ~5 sec.

b. Switch off the Clock generator. This feeds clock signal of 800 MHz, +20dBm to the ROACH boards.

c. No need to switch off the SMPS used for PPS unit. This will get switched off directly from mains.

d. No need to switch off the infiniband switch. This will get switched off directly from mains.

e. Halt the control PC (192.168.4.68).

NOTE : a. ssh -X root@192.168.4.68 (gmrttifr) b. sudo halt -p

f. Halt the compute nodes i and host nodes by executing the script shutdown.sh in gwbh6 home folder.

NOTE : a. ssh -X gpuuser@gwbh6 b. ./shutdown.sh

## 2. Switch ON procedure

a. Switch ON the control PC (192.168.4.68) in rack 3. It is 1 U pc.
b. Make sure the infiniband switch is ON.
c. Make sure the PPS unit is Switched ON.
d. Switch ON the Clock Generator. Set the frequency to 800 MHz, amplitude to +20dBm, RF ON.
Instructions on How to set clock settings :


1. Power ON the clock geneator by clicking the POWER button at botton left hand corner.
2. Set the clock to 800MHz. By clicking on the FUNCTION knob the cusrsor can be moved and value can be changed by rotating the knob.
3. Set the amplitude to +20dBm using the FUNCTION knob.
4. Click on the RF STANDBY button to turn RF ON.

e. Switch ON the ROACH UNITS in all racks 1,2,5,6 by holding down the Black switch on the front panel for ~2 sec.
f. Swich ON the compute nodes and host machines in all racks.

# Appendix – 8 GWB NETWORK DIAGRAM