Standard Operating Procedure for the GMRT Software Back-End (GSB)

($ *Version 2.1 , Oct 27th, 2009* $)

1. Basic Usage Modes of the GSB :

The GSB offers different modes of usage which are summarized below in Table 1.

Table 1: GSB modes

#	Observation Type	Usage Mode	Acquisition BW (MHz)	Input IF BW (MHz)	Number of channels
1.	Continuum with BW > 16 MHz (e.g. GMRT bands from 325 to 1420 MHz)	TOTAL INTENSITY	32	32 / 16	256 or 512
		FULL STOKES ‡		6	
2.	Continuum with BW <= 16 MHz (e.g. GMRT bands below 325 MHz)	TOTAL INTENSITY	16	16	256 or 512
		FULL STOKES		6	
3.	Spectral Line	TOTAL INTENSITY	16 (decimated by factor of 4 or more, in powers of 2)	16	256
		FULL STOKES †		6	
4	Beam Mode : IA (Incoherent Array)	TOTAL INTENSITY	16	16 / 6	256
5	Beam Mode : PA (Phased Array)	TOTAL INTENSITY	16	16 / 6	256
		FULL STOKES ‡	16 or 32	32,16,6	256 or 512

<u>*Note :*</u>

† *Under testing.* ‡ *Not Released.*

(i) *Default integration time of basic STA is ~ 2 seconds.*

(ii) *Spectral line mode has 16 MHz input BW which is low pass filtered and decimated to smaller bandwidths, by factors of 4 or more (in powers of 2), resulting in output BW of 4 MHz or less.*

2. GSB Console :

Before starting the observing session, user need to configure the GSB in the desired *mode*. For this purpose, the **GSB Configuration GUI** can be used to generate a GSB configuration setup file called **'gsb.hdr'**. The information given in this ascii file is used to configure & initialize the GSB and it's real time data acquisition system. On completion of GSB configuration setup, the **'gsb.hdr'** file is stored automatically on three required machines.

How to Execute ? The GSB configuration GUI is available on observer@astro0 machine as

/home/observer/bin/gsb_config.pl

On execution, a GUI will appear on the screen with number of menu driven options, as shown below. Select the desired options and use the "Save" button to save the configuration.
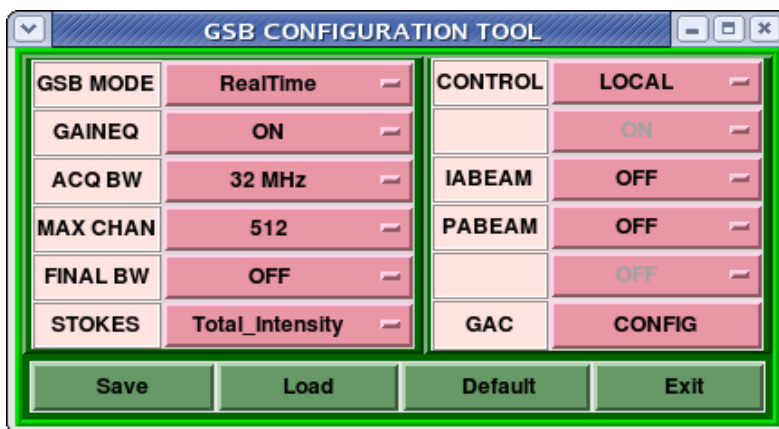
3. GSB DAS Console :

The GSB DAS (*Data Acquisition System*) console is a workspace which provides an integrated graphical user interface to run a number of GSB and DAS chain programs. Depending upon the GSB setup file (***gsb.hdr***) created by the GSB configuration GUI (see section 2), the user can configure the GSB and initiate the DAS chain in the desired 'mode'.

3.1. gsb_dasd :   The gsb_dasd is a DAS daemon process which runs on the GSB host and data machines.   The gsb_dasd acts as a server which listens/communicates with client processes of DAS console. This daemon is always up, starting at the time the machine(s) are booted.   At certain times, the process may need to be re-started on the following machines, with the appropriate argument :

User@Machine	Command	Path for gsb_dasd
gsbuser@gsbm1 (*GSB host*)	gsb_dasd gsbuser	/home/gsbuser/bin/gsb_dasd
observer@gsbm4 (*IFR data host*)	gsb_dasd pulsar	/home/gsbuser/dvl/bin/gsb_dasd
gsbuser@node49,50 (*IA,PA beam hosts*)	gsb_dasd gsbuser	/home/gsbuser/bin/gsb_dasd
gsbuser@node49,50 (*Beam data hosts*)	gsb_dasd gsbuser	/home/gsbuser/bin/gsb_dasd

3.2. gsb_dasconsole : This program open a GUI for the DAS console. The DAS console is split into two main parts : one for the Interferometry and the other for the IA and PA beams.   Each can be invoked using the '***Start***' menu button on the corresponding task bars named "***IFR-Windows***" and "**BEAM-*Windows***".

*How to Execute ?   observer@astro0:/*home/observer/bin/gsb_dasconsole

4. GSB Control :
The GSB can be run either in full ONLINE control mode, or in a local control mode.

4.1 ONLINE control :
Issue the commands in the sequence given below on the ONLINE host machine (shivneri or lenyadri) to establish the ONLINE interface to the GSB :

Window-1 : dassrv : login observer@shivneri / lenyadri
 > /odisk/online1/gsbe/dassrv-dvl/dassrv

Window-2 : USER0 : login observer@shivneri / lenyadri
 > **allant/antmask; cmode X;tpa(11)=15;initndas '/temp2/data/gsb.hdr'**
   // Initialize GSB/GHB DAS chain.
   *// Where **cmode X** is 3 for default correlator mode for GMRT Hardware Backend (GHB).*
   //   8 for only GSB.
   //   15 For both GSB and GHB.
   // Note : To run both the back ends simultaneously, please incorporate hardware back-end
   *//   configuration file keywords (from '**corrsel.hd**r') into **gsb.hdr**.*

 > allant/antmask; subar x; prjtitle ' <project title>' ; prjobs '<observer> ';initprj(15,'PRJCODE')
   // Initialize add new project with project title and observer information.
   // about 'initprj' arguments, read GHB SOP available in control room.
   // NOTE : Before issuing INITPRJ command, wait till GSB receives the first GPS pulse,
   //   occurring at completion of a minute.
  :
 > subar X ; stpproj   *// delete project*
 > hltndas   *// finish das chain*

Window-3 : USERX : login observer@shivneri / lenyadri (Value of X can be from 2 to 5).

   > allant/antmask;cp 0;defs x; subar x   *// define sub-array with antenna masks*

   > lnkndas   *// Establish user terminal's communication with 'dassrv'*

   > TPA   <RF1 RF2   First LO-1 First LO-2 Fourth LO-1 Fourth LO-2
    // e.g. Fill the TPA array to set fringe stop frequency for 1st channel : TPA 325 325 255 255 70 70
   > prjfreq   *// Set frequency*

   > gts '<source>'   *// give source name*

   > strtndasc   *// Start data acquisition*

   > stpndasc   *// Stop data acquisition*

4.2 LOCAL Control :

Table 4.2 shows basic 'getcmd' sequence of commands to control the GSB DAS chain, and the equivalent command /script name which can be run on the ONLINE host machine. The 'getcmd' process reads the GSB configuration parameters from the header file '*gsbuser@gsbm1:/tmp/gsb.hd*r' and the observation parameters like observing frequency and source RA-DEC from the header file *gsbuser@gsbm1:/tmp/getcmd.hdr*. These header files can be created using programs given below.

i. observer@astro0:/home/observer/bin/gsb_config.pl *// creates* */tmp/gsb.hdr* *file on gsbm1 machine.*

ii. gsbuser@gsbm1:/mnt/code/gsbuser/bin/realtime/mkscan <PROJCODE>
// creates */tmp/getcmd.hdr* *// file containing information about source RA-DEC, frequency of fringe-stop,*
// and project information
// ***Note :*** *to create /tmp/getcmd.hdr file for a given project code (PROJCODE), GHB das-chain must be*
// running with data acquisition scan.

iii. gsbuser@gsbm1: /mnt/code/gsbuser/bin/realtime/getcmd
  Enter the getcmd commands as per the sequence given in column 2 of table 4.2...

  OR observer@shivneri[or lenyadri]:/home/observer/bin/<script name>
  Run the scripts as per the sequence given in column 1 of table 4.2...

TABLE 4.2 *GSB Local Control*

Script on ONLINE host machine	Commands on 'getcmd' terminal (GSB host)	Description
1. initndas.gsb	***das init /tmp/gsb.hdr***	Initialize and Configure GSB and DAS-chain.
2. initprj.gsb	***das addproj /tmp/getcmd.hdr***	Initialize project with information provided in /tmp/getcmd.hdr file. ***Note : Before issuing command,wait for GPS pulse required in GSB processes.***
3. strtndas.gsb	***das startproj /tmp/getcmd.hdr***	Start the data acquisition scan based on project code given in /tmp/getcmd.hdr file.
4. stpndas.gsb	***das stopproj <PROJCODE>***	Stop the data acquisition scan for a given project code.
5. stpprj.gsb	***das delproj <PROJCODE>***	Delete the project.
6. hltndas.gsb	***das finish***	Das chain is halted.

5. Real Time monitoring of GSB data :

5.1 Interferometry Data Monitoring Console :
How to execute? observer@gsbm4 **:/home/gsbuser/dvl/bin/gsb_dasmon**
                 OR simply invoke using the button "GSB_IFR_MON" in main GSB GUI

5.2 Pulsar Monitoring Console :
The older version of psr_mon is currently available for use (see sec 7.9 for details)

6. GSB Offline Data Monitoring and Analysis Software :

6.1 GSB Interferometry LTA data :
Currently interferometry data is stored on observer@gsbm4 machine where offline data monitoring
tools and analysis software are available.

DATA Location : observer@gsbm4:/gsbifrdata/<date>/<GSB LTA FILE>

DATA Monitoring Tools :
The main tools available are as follows (help for these can be accessed either by '-h' option or is available in shell of the data monitoring tool itself, by 'explain' command) :

1. tax (Tk Assisted Xtract)

2. gsb_ltahdr   (ltaheader)   : Gives information about LTA file along with scan wise information.

Data Analysis Software :

1. rantsol :   Task to compute the antenna gains from a point source visibility in LTA format.

2. LTA utilities :   All LTA utilities available for GHB data, have corresponding GSB versions available.
   These include **gsb_ltahdr, gsb_ltasel, gsb_ltatime, gsb_ltacomb, gsb_ltaclean , gsb_diffstop** etc.

3. LTA to FITS conversion programs :
   a. gsb_listscan : Take LTA file name as input argument and create output log file which
      is required for LTA to FITS conversion program. The log file contain conversion control,
      flag control parameters and data selection parameter which can be edit.
      Usage : gsb_listscan <LTA file-name> **// CLASSIC_NORM=ON/OFF optional.**
   b. gsb_gvfits : Takes input file created by 'gsb_listscan' program and produce FITS format file as a output.
      Usage : gsb_gvfits <Input parameter file >

   **NOTE : GSB LTA FILES acquired before Aug 10th , 2009 required scaling while converting the data
            in to FITS file. Hence use
            gsb_listscan.with_scaling <LTA file-name>** **// keep CLASS_NORM=ON**
            gsb_gvfits.with_scaling <Input parameter file>

7.   Pulsar Beam Mode Operations (Applicable for IA & PA together)

7.1 NOTE: CURRENTLY, BEAM MODES ARE AVAILABLE FOR THE FOLLOWING CONFIGURATION
   A. Total Intensity (RR+LL) for IA & PA
   B. 256 SPECTRAL CHANNELS
   **C. 61.44 microsecond is the highest time resolution available. (i.e. TIME_INT = 2 and above
        is possible in ia_scan.hdr & pa_scan.hdr)**
   **D. Presently IA & PA has to be run together. User wanting only IA OR PA may process only
        beam whichever they want. But to start with in GSB CONFIGURATION, both modes needs to be
        turned ON. (as mentioned in Sec. 7.2 by points 1 & 2)**

**7.2 BEAM Operation : Run the GSB in default interferometer mode with the following SPECIFIC settings
    in the GSB Configuration GUI :**
   1. IA BEAM = "ON"
   2. PABEAM = "ON"   (both IA & PA need to be turned ON in current version)
   3. ACQ BW = "16 MHz"
   4. MAX CHAN = "256"

7.3 GSB DAS CONSOLE Windows : Start all windows (IFR, IA, PA)
      One needs to do this in beginning itself

7.4 Start only IFR programs (viz. acq, collect) at this moment.

7.5 Start GSB in interferometer mode (i.e. initndas.gsb, initprj.gsb, startndas.gsb)

**7.6 Select the desired antennas in IA & PA mode, using the GSB_GAC_CONFIG utility in the main GSB GUI.
      The selections become effective when a new GSB scan is started (e.g. strtndas.gsb command).**

**7.7 Phasing of the array is possible by using the GSB_PHASING utility in the main GSB GUI. However, the
      present version uses data from all antennas for the phasing calcualtion, and does not allow for disabling
      unwanted antennas. This will be shortly replaced by a GUI that allows user selections.**

7.8 **Start process_psr, collect_psr for IA & PA (in DAS CONSOLE GUI) [top panel => process_psr, middle panel => collect_psr, lower panel => unused at present.]**

7.9 **Click GSB_IA_SCAN (in GSB MAIN CONSOLE) which will open a window on node 33 (IA). Edit ia_scan.hdr for post integration factor. Default value is 2 (TIME_INT=2) [2*30.72 micro sec]**

7.10 **Click GSB_PA_SCAN (in GSB MAIN CONSOLE) which will open a window on node 34 (PA). Edit pa_scan.hdr for post integration factor. Default value is 2 (TIME_INT=2) [2*30.72 micro sec]**

7.11 **start GSB BEAM DAS CHAIN from main ONLINE window (on shivneri/lenyadri) from where IFR is getting controlled. Use the following commands :**

--> initndas.ia (for IA)
--> initndas.pa (for PA)
--> strtndas.ia (for IA)
--> strtndas.pa (for PA)

--> stpndas.ia (for IA)
--> stpndas.pa (for PA)
--> hltndas.ia (for IA)
--> hltndas.pa (for PA)

7.12 **"psr_mon" – old version is currently available ; from nodes 35 & 36; login as "gsbuser"**
   usage as usual   e.g. "psr_mon -c -n 1 0 0 -M 1 -m 2.0 -i 0"
   --> "psr_online.in" is in current dir when terminal is opened
   (/home/gsbuser/ACQPSR/IA/ and /home/gsbuser/ACQPSR/PA)
   --> click GSB_IA_PSR_MON to open terminal (node 35) for IA
   --> click GSB_PA_PSR_MON to open terminal (node 36) for PA

7.13 **"record_psr" ; from nodes 35 & 36 (for IA & PA, respectively); login as "gsbuser"**
   DATA DIR = /mnt/d/gsbuser/ (make your directory here..)
   usage as usual e.g "record_psr -f /mnt/d/gsbuser/ia_test.raw -n 1 -m 1"
   --> USE RECORD DIR as /mnt/d/gsbuser/ (for both IA & PA)
   --> click "GSB_IA_REC" to open terminal (node 35) for IA
   --> click "GSB_PA_REC" to open terminal (node 36) for PA

8. Data Backup Policy :

8.1 Interferometry Data:

It is requested to all users to take immediate backup after the GTAC observing session ends.

The interferometry data recorded on 'gsbm4' machine in area /gsbifrdata/<date>/ will be deleted as per the need of disk space.

Login : observer@gsbm4
Data Location : /gsbifrdata/<date>/

Backup of GSB observation data will not be available with the observatory.

8. IA/PA BEAM Data:

It is requested to all users to take back-up of the beam data from node49
and node50 local disk using SDLT600 tape drive (/dev/nst1) connected to GSB
(test1a). The commands need to be used are given below

ssh test1a "mt -f /dev/nst1 status"
tar cvfb - 20 <data file> | ssh test1a "dd of=/dev/nst1 obs=20b"

Note : Please take back-up when GSB is not in use for pulsar observation.
    As with earlier systems, there is no observatory back-up of beam mode data.