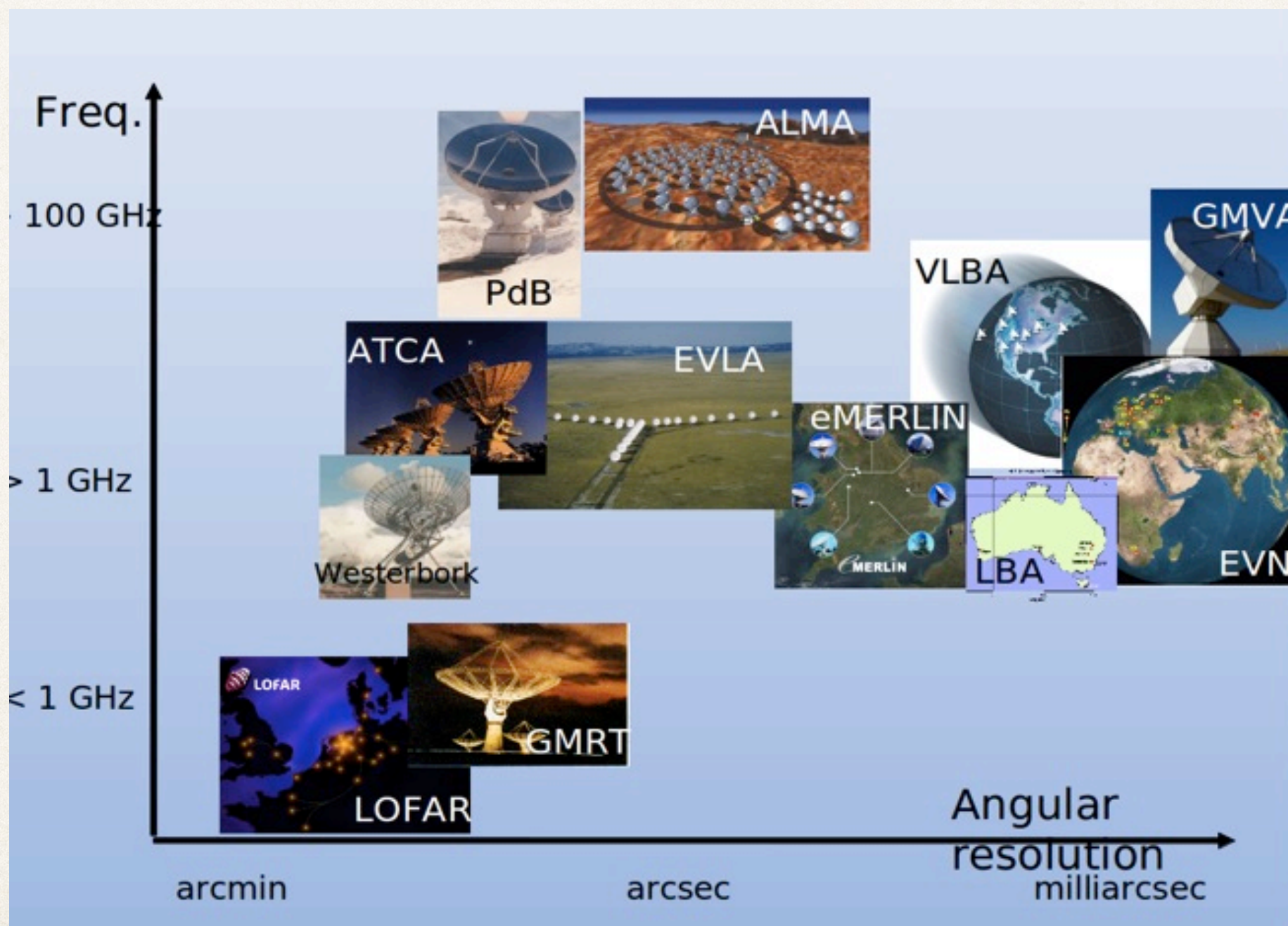# Writing a GMRT Proposal

Preeti Kharb

NCRA-TIFR

Thanks to Poonam Chandra (NCRA-TIFR)

Why a Proposal?

* To test a scientific hypothesis

* Telescopes like the GMRT are open to the worldwide scientific community

* Compete for observing time
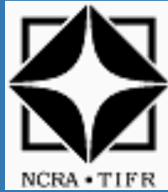
* Proposal writing skills are essential for funding

Telescopes & Frequencies

T. Savolainen

Proposal Submission

✤ GMRT Time Allocation Committee (GTAC) invites proposals for 2 Cycles (April to September and October to March).

✤ **Deadlines** 15 January and 15 July

✤ Proposals must be submitted online via NCRA Archive & Proposal System, NAPS

✤ Proposals must be submitted by the Principal Investigator (PI)

✤ Co-Investigators (Co-Is) need to be registered users

✤ All proposals processed by GTAC with external refereeing and inputs from the GMRT Observatory on technical issues

NCRA Archive and Proposal System

✤ https://naps.ncra.tifr.res.in/naps/login

3 Components of a Proposal

1. **Cover sheet**: Title, Abstract, Affiliation, Collaborators, Targets & Observing time

2. **Scientific Justification**: Science case for your observations

3. **Technical Justification**: Details of time request, Bands, Exposure Time Calculator (ETC)

Proposal Components

✤ **Abstract**: Short summary of the science, time request and frequency(ies)

✤ **Scientific Justification**: **(1)** Introduction + **(2)** Previous work/Proposed targets + **(3)** How the science goals stated in the Introduction will be met

✤ **Introduction**: What is the big picture? What are the open questions? Why is the proposed science <u>essential</u> for answering the open questions?

✤ **(1)+(2)+(3):** Make it understandable to an undergraduate student or a non-expert. Make it quantitative. Include explanatory figures

✤ **Technical Feasibility**: Show that with the proposed time request, you will be able to achieve your science goals (detect features at $>5\sigma$ level?)

(Note: This PDF is generated by version 1.44 coversheet generator script running in LaTeX mode)

Proposal Code: 33_112

Submission Date: 17-07-2017

Title: Investigating rare kpc-scale extended jet-lobe radio morphologies in narrow line Seyfert 1 galaxies (NLS1s)

Related Proposals:

Abstract:

Narrow line Seyfert 1 galaxies (NLS1s) belong to a subclass of active galactic nuclei (AGN) that show broad permitted Balmer emission lines of relatively narrower (FWHM < 2000 km s^{-1}) widths than that are usually seen in normal AGN i.e., FWHM $\sim 5000 - 10000$ km s^{-1}. NLS1s are believed to possess smaller super-massive black holes (SMBHs; $\sim 10^5 - 10^8$ M$\odot$) with relatively higher accretion rates. Also, unlike BL-AGN, the fraction of radio-loud NLS1s is much lower. Systematic radio observations have shown that NLS1s mostly exhibit compact radio emission, even at sub-arcsec and milli-arcsec. Contrary to BL-AGN, the kpc-scale radio structures (KSRs) in NLS1s are rare. For instance, hitherto, only ten NLS1s are known to exhibit KSRs with jet-lobe morphologies. Recently, we have discovered 11 new NLS1s showing KSRs. Our newly discovered sources have nearly doubled the number of known NLS1s with KSRs. The presence of powerful radio-jets in NLS1s possessing relatively smaller is intriguing, and, therefore, these sources can offer insights in the evolution of large-scale radio structures at the lower end of the AGN mass function. With the aim to understand the formation and evolution of powerful AGN jets in NLS1s we propose to carry out deep multi-frequency imaging with uGMRT at 1.4 GHz, 610 MHz and 325 MHz for all our newly discovered 11 NLS1s.

Proposers:

The first name on the list of proposers is the Principal Investigator for this proposal.

Proposer	Institution	Observer	Email	Nationality	PhD Student
Veeresh Singh	PRL	Yes	veeresh.iia@gmail.com	INDIA	No
C.H. IshwaraChandra	NCRA	Yes	ishwar@ncra.tifr.res.in	INDIA	No
Preeti Kharb	NCRA	No	preeti.kharb@gmail.com	INDIA	No
Hum Chand	ARIES	No	hum@aries.res.in	INDIA	No

Phd Students table:

PI Contact Details:

Address: Astrophysics and Astronomy Division
Physical Research Laboratory

City: Ahmedabad
State: Gujarat
Country: INDIA
Telephone: +91 79 2631 4614
Fax:

Scientific Categories: Active galaxies

Time Requested Summary:

Band 2 (130-260 MHz)	Band 3 (250-500 MHz)	Band 4 (550-900 MHz)	Band 5 (1000-1450 MHz)	Total Time Requested (hrs)
0.0	27.5	27.5	27.5	82.5

Authors have been allotted time in GMRT before: No

Data Reduction at: home

Support Required: none

A 610 MHz uGMRT Survey of the Palomar-Green "Quasar" Sample

Our goal is to investigate the radio emission in the Palomar-Green (PG) "quasar" sample using the uGMRT at 610 MHz. The PG "quasar" sample is one of the best-studied samples of nearby active galactic nuclei (AGN), with extensive supplementary information available. These include accurate black hole masses, high-resolution spectra of the broad and narrow line regions of the AGN, data on radio outflows, information on host galaxy stellar and gas properties, as well as their galactic environments. We propose here a low-frequency survey of the PG sample with the uGMRT. Through this study we expect to detect diffuse radio emission from these AGN as well as the host galaxies and learn about the accretion disk−jet connection, AGN duty-cycle and the role of AGN feedback on host galaxies and intergalactic medium.

Background and Motivation

AGN are the energetic centres of galaxies that are believed to be powered by mass accretion and the release of gravitational energy onto supermassive black holes (BHs; $10^6 - 10^9$ $M_\odot$). Bipolar outflows are launched perpendicular to the BH−accretion disk systems. While the BH spin and mass, along with the accretion rate are considered crucial to the launch and power of the bipolar outflows, the exact mechanisms that take place at the BH−accretion disk interface and the bases of outflows, is a long-standing open question. It is not clear why only 15% of AGN launch powerful outflows that extend to hundreds of kiloparsecs or megaparsecs (the so called "radio-loud" AGN), while the vast majority of AGN launch no or weak outflows that are typically < 10 kpc in extent and often diffuse or wind-like (the "radio-quiet" AGN).

It is unclear how the host galaxy has any influence on the type of outflows that are launched, since radio-loud AGN are almost exclusively hosted by elliptical galaxies while radio-quiet AGN reside in spiral or lenticular galaxies. Differences in BH masses, spins and accretion rates have often been suggested to explain the radio-loud/radio-quiet divide. However, ample evidence to the contrary exists for individual sources (see the recent review by Padovani et al. 2017).

To address these difficult yet urgent questions, it is imperative to study an AGN sample at all possible wavelengths (radio, IR, optical, UV, X-rays) and all possible spatial scales (from milli-arsecond to arminute scales). Studying such a sample can reduce systematic biases and help us unambiguously explore the fundamental connections between different parts of the AGN (e.g., the disk-jet connection) as well as the host galaxy. The Palomar-Green (PG) "quasar" sample of nearby AGN is arguably the best such sample.

The Palomar-Green "Quasar" Sample

The parent Palomar-Green sample comes from a UV-excess photographic survey carried out in the U and B bands with the Palomar 18 inch Schmidt telescope in the late 1970s, and comprises nearly 1800 objects (Schmidt & Green 1983). The PG "quasar" sample, which is our sample of interest here, comprises all 87 quasars and Seyfert type 1 galaxies at $z < 0.5$ (Boroson & Green 1992). Note that for the purpose of this proposal, we henceforth refer to both Seyfert 1s and quasars collectively as ``quasars''. The PG "quasar" sample is the most comprehensively observed and studied low-redshift AGN sample.

The wealth of data that exists for the PG "quasar" sample include (a) accurate black hole masses measured from reverberation mapping (e.g., Peterson et al. 2004) as well as from single-epoch spectroscopy data (Vestergaard & Peterson 2006); (b) Hubble Space Telescope imaging data revealing the host galaxy morphologies; host galaxy bulge/disk decompositions for a substantial fraction of the sample (e.g., Kim et al. 2008, 2017); (c) extensive data covering radio to hard X-rays resulting in very complete broad-band spectral energy distributions (SEDs) and accurate bolometric luminosities (e.g., Shang et al. 2011); (d) observations of molecular gas content enabling examination of host galaxy star formation properties (Evans et al. 2006); and (e) infrared data

[2].

point out in their recent review that episodic AGN activity is likely to be more prevalent that previously supposed, because of the non-availability of sensitive low frequency data. The uGMRT wide-band data will be used to derive in-band spectral indices. uGMRT data will be used in conjunction with existing 5 GHz VLA data to get additional spectral index information.

3. Interesting sources showing the presence of relic emission will be observed in multiple uGMRT wavebands in followup observations, to carry out a detailed spectral ageing study. The detection of relic radio emission will help us constrain the important, yet illusive, AGN duty cycles (i.e., the fraction of time that the AGN is active versus inactive). We will examine the radio properties along with the host galaxy properties like gas kinematics and star-formation rates. This information is essential for studying the "AGN feedback" phenomenon that connects black hole growth to host galaxy bulge growth.

4. We will re-examine the fundamental plane of AGN with more sensitive radio data measurements of the PG sample, thereby reducing the scatter in this important relation. This will aid us in clearly identifying the prime drivers in AGN jet production.

Technical Justification

We propose to observe all 87 PG sources for 30 mins each with the uGMRT at 610 MHz. Including 5 mins on either side for phase-calibration and slewing, the effective total observing time per target will be 45 mins. For 87 targets, this will amount to 65.25 hours. We therefore **request a total of 66 hours**, including time for flux and bandpass calibration. Due to the wide bandwidth, the UV coverage from 30 mins on source, will be sufficient to image the extended emission.

The GMRT exposure time calculator (using a bandwidth of 300 MHz at 610 MHz) and our prior observing experience with the uGMRT suggests that we will be able to reach rms noise levels of $20 - 30$ μJy beam^{-1} with these exposure times. With a resolution of $\approx 5'' - 7''$ at 610 MHz, the GMRT beam will span the lobes in these AGN at

resolutions that are intermediate between the previous VLA observations (resolutions $2''$ and $18''$).

References

Boroson, T., & Green, R. 1992, ApJS, 80, 109.

Evans et al. 2006, AJ, 132, 2398.

Gallimore, J., Axon, D., O'Dea, C., Baum, S., Pedlar, A. 2006, AJ, 132, 546.

Harrison, C. et al. 2015, ApJ, 800, 45.

Ho L. 2008, ARA&A, 46, 475.

Ho L. & Ulvestad J. 2001, ApJS, 133, 77.

Kellermann, K., Sramek, R., Schmidt, M., Green, R., Shaffer, D. 1994, AJ, 108, 1163.

Kellermann, K., Sramek, R., Schmidt, M., Shaffer, D., & Green, R. 1989, AJ, 98, 1195.

Kharb, P., Srivastava, S., Singh, V., Gallimore, Ishwara-Chandra, et al, 2016, MNRAS, 459, 1310.

Kim et al. 2008, ApJ, 687, 767.

Kim et al. 2017, ApJS, 232, 21.

O'Sullivan, E., Giacintucci, S., David, L., Gitti, M., Vrtilek, J. 2011, ApJ, 735, 1.

Padovani, P. et al. 2017, A&ARv, 25, 2.

Peterson, B. et al. 2004, ApJ, 613, 682.

Morganti, R. 2017, Nature Astronomy, 1, 596.

Shang et al. 2011, ApJS, 196, 2.

Shi, Y., Rieke, G. H., Ogle, P., Su, K. Y. L., & Balog, Z. 2014, ApJS, 214, 23.

Vestergaard & Peterson 2006, ApJ 641, 689.

[3].

Some more on Scientific Justification

✤ Highlight previous observations at radio and other wavelengths, to put things in perspective

✤ If data exist, explain why you need more observations

✤ Demonstrate by numbers/figures that existing data are inadequate

Archival Data Search

✤ GMRT Data Archive (https://naps.ncra.tifr.res.in/goa/data/search)

✤ TIFR GMRT Sky Survey, TGSS archive @150 MHz (http://tgssadr.strw.leidenuniv.nl)

✤ VLA NVSS archive @1.4 GHz, 45 arcsec (https://www.cv.nrao.edu/nvss/)

✤ VLA FIRST archive @1.4 GHz, 5 arcsec (https://www.cv.nrao.edu/first/)

✤ ATNF archive for ATCA @1-2 GHz, <9 arcsec (https://atoa.atnf.csiro.au)

GMRT Data Archive

Some more on Technical Justification

✤ Clear justification of Technical choices: Receiver frequencies, RFI considerations, special requests. <u>Talk about Resolution</u>

✤ Demonstrate that you will reach the required signal-to-noise ratio in the time requested. Note the expected r.m.s. noise. <u>Talk about Sensitivity</u>

✤ Include expected <u>overheads</u> (setup time, slew time, calibration time, position switching time etc.) in total time request

✤ Now, ETC. Attach ETC page to proposal.

✤ If non-standard setups or a very stringent scheduling is needed, then consult the GMRT observatory staff before submitting the proposal

✤ **COMPLETE** consistency between the Cover sheet and Technical justification

Submit your proposal online via NAPS

If your proposal does not get accepted

Incorporate the GTAC comments and submit again for the next cycle

If your proposal gets accepted

Preparing for your observations

http://www.ncra.tifr.res.in/ncra/gmrt/gmrt-users

Observing Help

Monitoring Tools

Observing Help & Monitoring Tools

home

For Astronomers	For Engineers
User Documents	**Antenna Systems**
GMRT Observer's Manual	Ondisplay Antenna Tracking Status
System Parameters and Current Status	Ondisplay History
Polarisation observations with GMRT (V2)	Feed position status
Dual band multi-pointing with GMRT (V2)	Pointing Offsets
GMRT Software Backend Documents	Wind Monitoring Station
uGMRT upgrade status	Antenna Wind Status
	Temperature Status
Before Observations	Servo data
GTAC Schedule [NCRA] [GMRT]	Electrical Power Status
White Slot Request[NCRA] [GMRT]	
Command file Creater and Observations Setup	**Analog Backend**
Command file Creater (GWB)	GAB Status, Band-Shapes, Temperature
Line Observations Frequency Setup (tune)	IF Band-Shapes and Deflection data
Source(s) Rise and Set Time	
GMRT Exposure Time Calculator	**Digital Backend**
VLA Calibrator Search	GSB band-shapes, Fringe Status
Dual band multi-pointing coordinates	GSB Amp-Phs(rantsol), Amp-Phs(xtract)
Online Archive (GOA)	Temperature
During Observations	**Hydrogen Maser**
Antenna Tracking Status	
Corr band shapes and Project State *	**Gmon Tools, Logs**
Gain-amplitude and Phase (rantsol)	
Visibility - amplitude and phase (xtract)	**Test Results, Callsheets and Schedules**
Antenna Wind Status	Useful scripts
Satellite passes	New Control and Monitor System (TGC)
	Recent Callsheets
After Observations	GMRT Upgrade Status
LTA to FITS conversion:	Results of Weekly PMQC tests
AIPS help:	GDDP, RFI status gray plots
RFI Plots:	Antenna Beam Width Plots
GDDP summary:	Schedules and white slot request
	Satellite tools
Contact	
* gmrtoperations@ncra.tifr.res.in	**Contact**
* snk@gmrt.ncra.tifr.res.in	astrosupp@gmrt.ncra.tifr.res.in
	snk@gmrt.ncra.tifr.res.in

http://gmrt.ncra.tifr.res.in/~astrosupp/

Preparing the Command File

GTAC observing inputs

Project information: ?

User's Name(s)..................	J K Ram	User's email address.....	xyz@abc.res.in
GTAC Code........................	33_123	Project Title...................	Galaxy survey
Observing slot start..........	29Aug2019 12:00	Observing slot end........	29Aug2019 12:00
Observing type...................	☑Continum/Imaging	☐Line/Spectroscopy	☐Pulsar/Beam

Telescope setup: ?

RF band (MHz)	Correlator (GWB) setup							
uGMRT band (sub band)	Start Freq (MHz)	Center Freq (MHz)	Stop Freq (MHz)	+/- BW (MHz)	Chan	Stokes	Integ (sec)	Beam (4)
band5 -- full (1000 - 1450)	1450	1250	1050	-400	2K	2	21.4	OFF

Source co-ordinates (list): ?

```
Source        Ra           Dec          Epoch

3C147      05h38m43.50s  +49d49'42.7"  1950.0
0837-198   08h37m11.18s  -19d51'56.8"  2000.0
NGC1851    05h14m06.30s  -39d02'50.0"  2000.0
```

Command file: ?

Task	Source_name	Time (minutes)
Receiver tunning	-----	5-25
Flux cal at beginning	3C48	8
Phase cal(s) and Target(s) source loop	1254+116 NGC5435	5 30
Flux cal at end	3C48	8

Special requirement or additional info (if any): ?

None.

Download Setup   reset

Important note: ?

Please email downloaded file to   gmrtoperations@ncra.tifr.res.in
For any queries, please write to   gmrtoperations@ncra.tifr.res.in

http://www.ncra.tifr.res.in:8081/~secr-ops/cmd2/cmd.html

Observing Strategy

✤ **Calibration Strategy**

  ✤ Amplitude calibrators, Bandpass calibrators

  ✤ Phase Calibrators

  ✤ Polarization Calibrators

✤ **Scheduling Constraints**

  ✤ Need quiet ionosphere, night observations (<610 MHz)

  ✤ Coordinated observations with other instruments (say ASTROSAT)

✤ Include in **Cover Sheet** of the proposal

Calibrators

✤ **Amplitude calibrators**, 3C48 (0137+331), 3C147 (0542+498) and 3C286 (or 1331+305) are used for both, amplitude and bandpass calibration

✤ **Phase calibrator** should be nearby, preferably within 15 degrees for 1.4 GHz and within 20 degrees at lower frequencies — Assumption being that sky conditions are the same for target & calibrator

✤ It should preferably be a point source, and 'P' type

✤　▪　P : <3% amplitude closure errors expected. Great for calibration!

✤　▪　S : 3-10% closure errors expected. Good for phase and gain (amplitude) calibration.

✤　▪　W : 0-?% closure errors expected. Suitable for calibration of phases only.

✤　▪　C : Confused source, probably not good to use for calibration.

✤　▪　X : Do not use.

Searching for a Phase Calibrator

VLA Calibrator Search For GMRT Users

This tool searches for the cal sources in VLA Calibrator List within the circle centered at target position

RA: [0]h [0]m [0]s   Dec: [0]d [0]' [0]"   Radius: [1]d   search
--OR--
RA: 13h40m00s   Dec: -20d50'00"   Radius: 10d   search

clear

```
## Target RA: 13h40m00.00s, Dec: -20d50'00.00", Search Radius: 10.0 (deg) ##


## Cal No. 1,  Angular Distance (radius: 5.1, ra: 4.3, dec: 3.1) deg ##
1357-177    J2000   A 13h57m06.074200s -17d44'01.904130"   Aug01
1354-174    B1950   A 13h54m22.041200s -17d29'24.787000"
--------------------------------------------------
BAND          A B C D     FLUX(Jy)    UVMIN(kL)   UVMAX(kL)
==================================================
 20cm    L  S S X X        1.40
  6cm    C  P P P P        1.00
3.7cm    X  P P P P        0.69
  2cm    U  S S S S        0.4
0.7cm    Q  W W W W        0.6


## Cal No. 2,  Angular Distance (radius: 5.5, ra: 0.2, dec: 5.5) deg ##
1339-263    J2000   A 13h39m19.890748s -26d20'30.495900"   Aug01
1336-260    B1950   A 13h36m32.486400s -26d05'18.359000"
--------------------------------------------------
BAND          A B C D     FLUX(Jy)    UVMIN(kL)   UVMAX(kL)
==================================================
 20cm    L  S S S X        0.50              6
  6cm    C  S S S S        0.60
3.7cm    X  P P P P        0.71                    visplot
  2cm    U  S S S S        0.50
0.7cm    Q  W W W W        0.21
```

http://gmrt.ncra.tifr.res.in/~astrosupp/calib/vlacal.html

Rise, Transit and Set time of Source(s)

Rise, Transit and Set times for the source(s) at GMRT

Observing date: 29 August 2019   Elevation Limit (degree) : 17.0

```
Source       RA            Dec            Epoch
3C147     05h38m43.50s  +49d49'42.7"  1950.
3C48      01h37m41.30s  +33d09'35.13"  2000.
3C286     13h31m08.29s  +30d30'33.0"  2000.
```

Enter the source coordinates in to the box :

VLA Calibrators list

[Calculate]   [clear]   [back]

Important Notes:

- **GMRT Latitude: +19d06'(N), Longitune : 74d03'(E)**

- **Elevation limit (Min) : 17.0deg**

- **Sky covered by GMRT: Declination +90d00' to -53d54'.**

- If source sets after midnight, please re-submit the querry using the next observing day to determine the set time.

Rise,Transit and Set Timings for the Source(s) @ GMRT

Date : 23 Nov 2018, Elevation : 17.0 deg, IST=UTC+0530

Source	RA	Dec	Epoch	Rise(IST)	Transit(IST)	Set(IST)	Rise(LST)	Transit(LST)	Set(LST)	UpTime(Hrs)
3C286	13h31m08.2879s	+30d30'32.958"	2000.	04:34:04	09:57:24	15:20:44	08:07:47	13:32:00	18:56:13	10:48:25
OQ208	14h07m00.3944s	+28d27'14.690"	2000.	05:11:56	10:33:09	15:54:21	08:45:45	14:07:51	19:29:56	10:44:10
PG1501+106	15h04m01.201s	+10d26'16.15"	2000.	06:29:05	11:30:04	16:31:03	10:03:07	15:04:55	20:06:44	10:03:36
1445+099	14h45m16.465213s	+09d58'36.072440"	2000.	06:10:59	11:11:23	16:11:47	09:44:58	14:46:11	19:47:25	10:02:26
PG1426+015	14h29m06.588s	+01d17'06.48"	2000.	06:06:27	10:55:18	15:44:09	09:40:26	14:30:04	19:19:42	09:39:16
PG1448+273	14h51m08.763s	+27d09'26.92"	2000.	05:57:16	11:17:08	16:37:00	09:31:13	14:51:58	20:12:42	10:41:29
1513+236	15h13m40.185630s	+23d38'35.200460"	2000.	06:23:28	11:39:37	16:55:45	09:57:29	15:14:30	20:31:30	10:34:01
PG1404+226	14h06m21.883s	+22d23'46.22"	2000.	05:17:46	10:32:32	15:47:19	08:51:36	14:07:14	19:22:52	10:31:16
1330+251	13h30m37.6892s	+25d09'10.978"	2000.	04:39:11	09:56:55	15:14:38	08:12:55	13:31:31	18:50:07	10:37:12
PG1351+236	13h54m06.432s	+23d25'49.09"	2000.	05:04:25	10:20:19	15:36:12	08:38:13	13:54:59	19:11:44	10:33:30
PG1341+258	13h43m56.748s	+25d38'47.69"	2000.	04:51:55	10:10:11	15:28:26	08:25:41	13:44:49	19:03:57	10:38:15
PG1310-108	13h13m05.789s	-11d07'42.40"	2000.	05:10:38	09:39:32	14:08:25	08:44:27	13:14:05	17:43:43	08:59:15
1248-199	12h48m23.898197s	-19d59'18.587620"	2000.	05:04:08	09:14:54	13:25:40	08:37:56	12:49:23	17:00:51	08:22:54
PG1244+026	12h46m35.248s	+02d22'08.79"	2000.	04:22:43	09:13:04	14:03:25	07:56:24	12:47:33	17:38:41	09:42:17
1254+116	12h54m38.255601s	+11d41'05.895070"	2000.	04:18:36	09:21:04	14:23:33	07:52:16	12:55:35	17:58:53	10:06:36
PG1229+204	12h32m03.605s	+20d09'29.21"	2000.	03:46:15	08:58:33	14:10:52	07:19:50	12:33:00	17:46:09	10:26:18
PG1211+143	12h14m17.670s	+14d03'13.10"	2000.	03:35:32	08:40:51	13:46:10	07:09:06	12:15:15	17:21:24	10:12:18

http://indrayani.ncra.tifr.res.in/~secr-ops/obs_setup/rst.html

Email the completed command files to "gmrtoperations@ncra.tifr.res.in"

GTAC observing inputs

Project information: [?]

User's Name(s)..................	J K Ram	User's email address.....	xyz@abc.res.in
GTAC Code........................	33_123	Project Title...................	Galaxy survey
Observing slot start..........	29Aug2019 12:00	Observing slot end........	29Aug2019 12:00
Observing type..................	☑Continum/Imaging	☐Line/Spectroscopy	☐Pulsar/Beam

Telescope setup: [?]

RF band (MHz)	Correlator (GWB) setup							
uGMRT band (sub band)	Start Freq (MHz)	Center Freq (MHz)	Stop Freq (MHz)	+/- BW (MHz)	Chan	Stokes	Integ (sec)	Beam (4)
band5 -- full (1000 - 1450)	1450	1250	1050	-400	2K	2	21.4	OFF

Source co-ordinates (list): [?]

Source	Ra	Dec	Epoch

```
3C147      05h38m43.50s  +49d49'42.7"  1950.0
0837-198   08h37m11.18s  -19d51'56.8"  2000.0
NGC1851    05h14m06.30s  -39d02'50.0"  2000.0
```

Command file: [?]

Task	Source_name	Time (minutes)
Receiver tunning	-----	5-25
Flux cal at beginning	3C48	8
Phase cal(s) and Target(s) source loop	1254+116 NGC5435	5 30
Flux cal at end	3C48	8

Special requirement or additional info (if any): [?]

None.

DDT Proposals

✤ Proposals that need data urgently (e.g., a gamma-ray burst followup) OR Proposals that want to carry out a Feasibility study before applying for a Large GMRT proposal using a special setup -

✤ Can request for Director's Discretionary Time (DDT)

✤ Submit a DDT proposal through NAPS, like a Regular proposal