TGE documentation

Asif Elahi*

1 Running TGE Code:

1.1 Required packages:

Three packages are required for the code: `cfitsio` , `gsl` and `fftw3`. The link to download the packages are here:

`cfitsio`: https://heasarc.gsfc.nasa.gov/fitsio/
`gsl`: https://www.gnu.org/software/gsl/
`fftw`: http://www.fftw.org/download.html

The packages follow the standard installation procedure as stated below:

```
./configure --prefix=/path/to/directory/
make
make install
```

1.2 Compilation:

After installation of the rquired packages, one needs to compile the code and get the excutable `tge`. This can be done using the `Makefile`. The command is:

```
make tge
```

Make sure the library path is correctly written in the `Makefile`. The default path is `/usr/local`.

*E-mail:asifelahi999@gmail.com

1.3 The input files:

If properly compiled, a mere `./tge` will show that the excutable takes three arguments: `input FITS file`, `input parameters file` and `output GV file`.

```
./tge
Usage: ./tge <input FITS file> <input parameters file> <output GV file>
```

inputparameters: The file `inputparameters` needs to be modified according to requirements. A copy of the `inputparameters` file is shown below.

```
10      1000      61      0.6

# Number of channels
# Umax
# FWHM of the PB at the central frequency of observation
# tapering parameter (f)
```

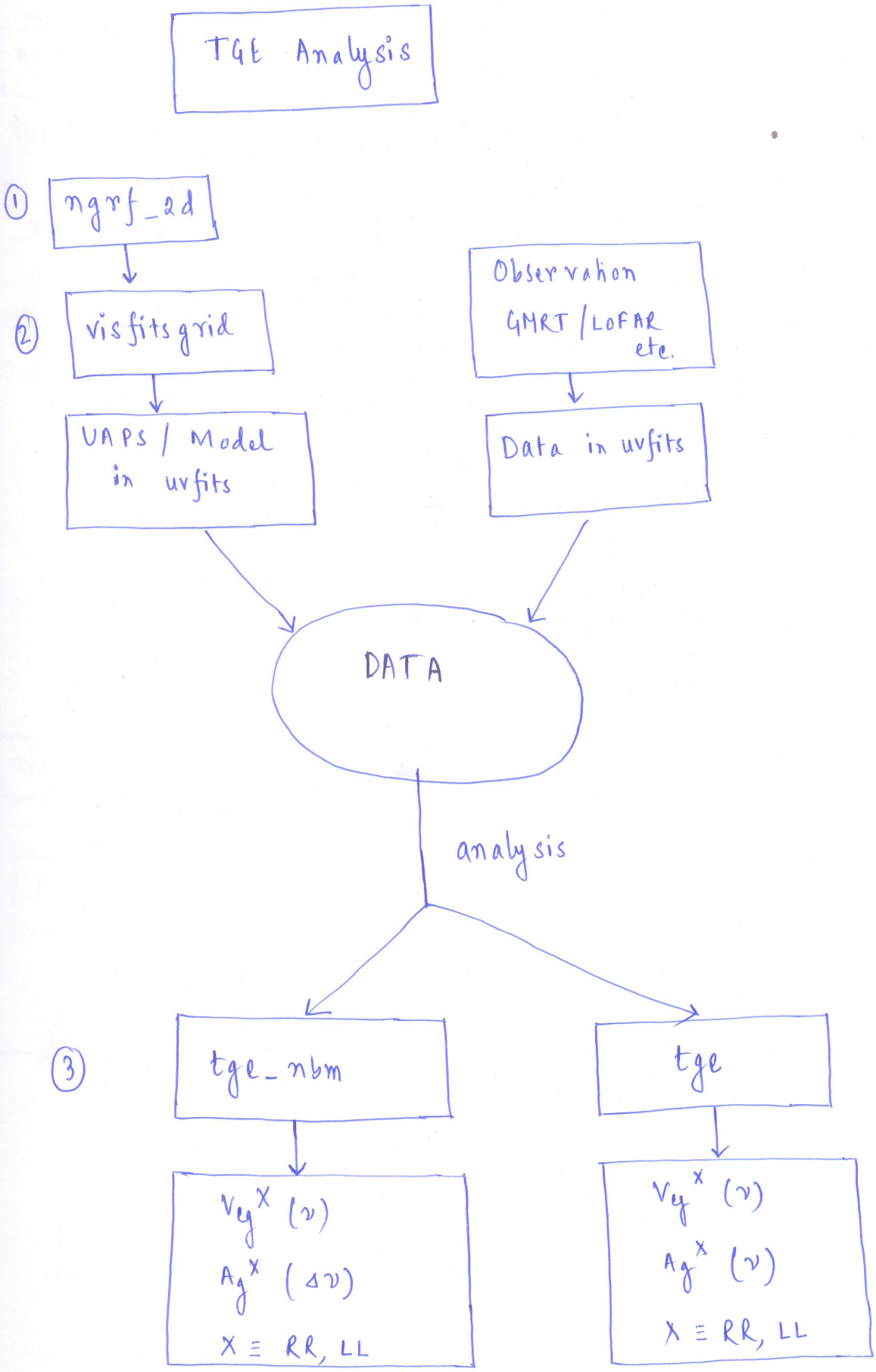
Once the input parameters are set the code can be run with the following command:

```
./wbtge test.fits inputparameters GV-data
```

Note that, it is recommended (but not necessary) to test the code. Refer to section 2 for testing.

2 Testing TGE:

There is a `test.fits` file in the TGE package. One polarization (RR or LL) is flagged in the channel numbers 6 and 7. If the input parameters are chosen as shown here, one will get 0 as result in the MAPS. The input parameters for testing: `chan1=6/7, chan2=6/7`, everything else can be kept arbitrary.


TGE Analysis
1
ngrf_2d
2
visfits grid
UVPS / Model in uvfits
Observation GMRT / LOFAR etc.
Data in uvfits
DATA
analysis
3
tge_nbm
tge
$V_g^X(\nu)$
$A_g^X(\Delta\nu)$
$X \equiv RR, LL$
$V_g^X(\nu)$
$A_g^X(\nu)$
$X \equiv RR, LL$

① ngrf_2d

- incorporates frequency dependence of PB and RJ factor
- output 2 images
  ① $T(\vec{\theta})$ at ν_e in K units
  ② $F(\vec{\theta}, \nu) = 2k_B \frac{\nu^2}{c^2} \times PB(\vec{\theta}, \nu) \times \Omega \times T(\vec{\theta}) \left(\frac{\nu}{\nu_e}\right)^{\alpha}$

Ω → Solid angle of pixel

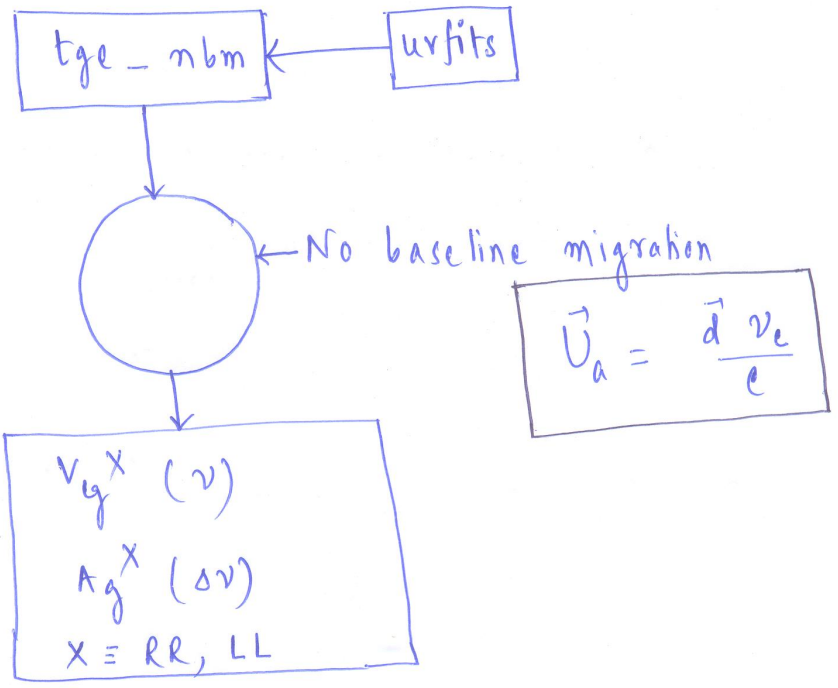
② vis fits grid ← $F(\vec{\theta}, \nu)$

↓ F.T. of F

↓ uvfits template → ○ interpolates replaces / adds Visibilities

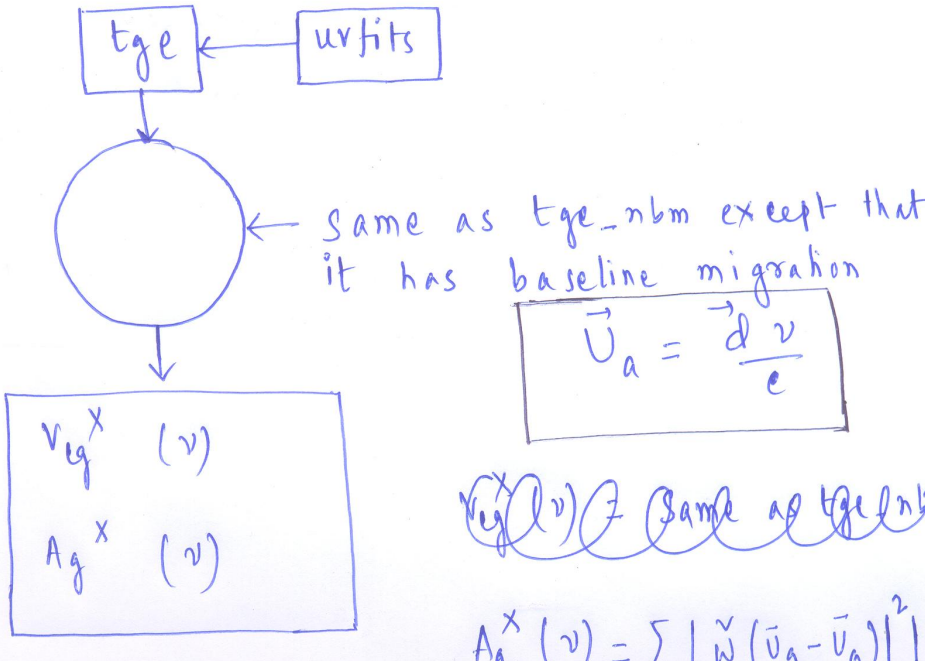
↓ Uvfits

③



$$V_{ig}^X(\nu) = \sum_a \tilde{w}(\vec{U}_g - \vec{U}_a)\, V_a^X(\nu)$$

$$A_g^X(\nu_n - \nu_m) = Re\left[\sum_{n=0}^{N_e-1}\sum_{m=n}^{N_e-1}\sum_a \left|\tilde{w}(\vec{U}_g - \vec{U}_a)\right|^2 V_a^X(\nu_n)\, V_a^X(\nu_m)^*\right]$$



$V_{ig}^X(\nu)$ same as tge_nbm

$$A_g^X(\nu) = \sum \left|\tilde{w}(\vec{U}_g - \vec{U}_a)\right|^2 \left|V_a^X(\nu)\right|^2$$