

Astrid Scripts

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Scripts are in Python !

Components

Antenna actions:

Scan Types
(Track, RALongMap)

Script Objects
(Location, Offset)

what to observe:

Catalogs
(source names and
coordinates)

how to connect the parts:

Configurations
(Receiver, frequency,
switching mode, ...)

Simple Observing Script

```
# load the configurations file
execfile ("/mypath/myconfigurations.txt")

# load catalogs file
Catalog("/mypath/mycatalog.txt")

Configure(myconfig) # configure the GBT

Slew("B0329+54")      # slew to the source

AutoPeakFocus()        # update pointing corrections

Configure(myconfig)    # configure again

Balance()              # balance the IF system

Track("B0329+54" ,None, 600) # observe the source
```

RTFMS

<https://science.nrao.edu/facilities/gbt/> → Observing

<https://science.nrao.edu/facilities/gbt/observing/GBTog.pdf>

Observing With The Green Bank Telescope



by GBT Scientific Staff

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Version 3.3

This guide provides essential information for the preparation of

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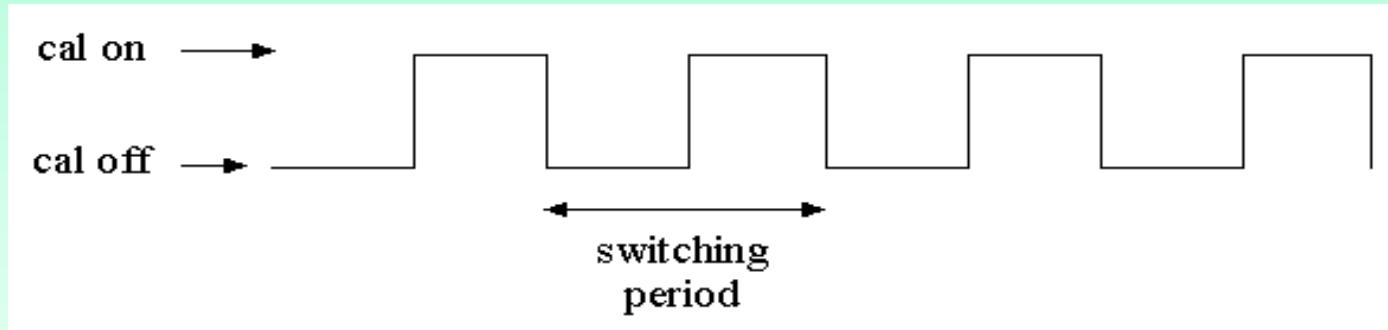
Configurations - continuum

```
# configuration for continuum observations
continuumconfig = """
    receiver  = 'Rcvr1_2'
    beam      = 'B1'
    obstype   = 'Continuum'
    backend   = 'DCR'
    nwin     = 1
    restfreq = 1400
    bandwidth = 80
    swmode    = 'tp'
    swtype    = 'none'
    swper     = 0.2
    tint      = 0.2
    vframe    = 'topo'
    vdef      = 'Radio'
    noisecal  = 'lo'
    pol       = 'Linear'
"""

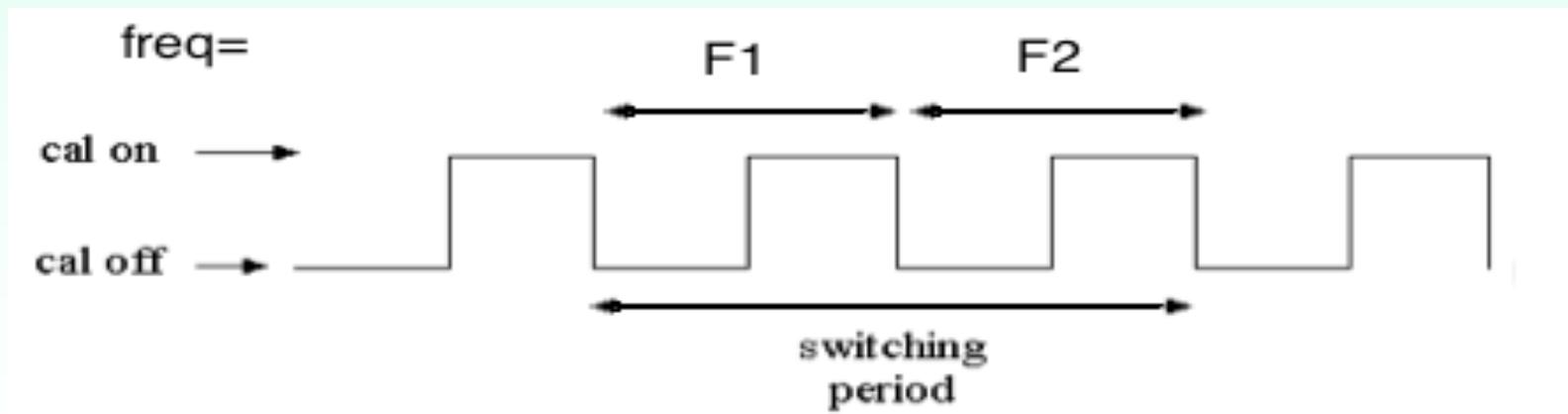
Configure( continuumconfig )
```

Switching modes

Total Power (swmode='tp' ; swtype='none')



Frequency Switching (swmode='sp' ; swtype='fsw')



Configuration – Spectral Line

```
# using frequency switching
vegasfsconfig="""
    receiver = 'Rcvrl_2'
    beam = 'B1'
    obstype = 'Spectroscopy'
    backend = 'VEGAS'
    nwin = 1
    restfreq = 1420.4057
    bandwidth = 23.44
    swmode = ' sp '
    swtype = ' fsw '
    swper = 1.0
    swfreq = 0, -2.5
    tint = 2.0
    vframe = 'lsrk'
    vdef = 'Radio'
    nchan = 'medium-high'
    vegas.subband = 1
    noisecal = 'lo'
    pol = 'Linear'
"""
"""
```

$$V_{\text{radio}} = c \left[1 - \frac{\nu}{\nu_0} \right]$$

$$V_{\text{optical}} = c \left[\frac{\nu_0}{\nu} - 1 \right]$$

$$V_{\text{relativistic}} = c \left[\frac{\nu_0^2 - \nu^2}{\nu_0^2 + \nu^2} \right]$$

Configuration - pulsars

```
receiver      = 'Rcvr_342'
restfreq     = 350.0
obstype       = 'Pulsar'
backend        = 'GUPPI'
pol           = 'Linear'
swmode        = 'tp_nocal'
swtype        = 'none'
noisecal     = 'off'
swper         = 0.04
swfreq        = 0.0
nwin          = 1
deltaf freq = 0
ifbw          = 80
bandwidth     = 100
tint          = 81.92e-6
vlow          = 0
vhigh         = 0
vframe        = 'topo'
vdef          = 'Radio'

guppi.obsmode = 'search'
guppi.numchan = 4096
guppi.polnmode = 'total_intensity'
guppi.scale   = 0.3
guppi.outbits = 8
guppi.datadisk = 'data2'
guppi.fold_dumptime = 10
guppi.fold_bins = 256
guppi.fold_parfile = "/users/rlynch/myparfile.par"
guppi.dm      = 50
```

Configuration – multiple spectral windows

```
# multi-beam receiver for nodding observations
vegasnodconfig = """
    receiver  = 'RcvrArray18_26'
    beam      = '1,2'
    # beam = 'B12'
    obstype   = 'Spectroscopy'
    backend   = 'VEGAS'
    nwin     = 4
    restfreq = 23694.495, 23722.633, 23870.129, 25056.025
    deltafreq = 0,0,0,0
    bandwidth = 100
    swmode    = 'tp'
    swtype    = 'none'
    swper     = 1.0
    tint      = 30
    vlow      = 0
    vhigh     = 0
    vframe    = 'lsrk'
    vdef      = 'Radio'
    noisecal  = 'lo'
    pol       = 'Circular'
    nchan     = 'low '
"""
"""
```

Configuration – multi-beams, multi spectral windows

```
# configuration definition for spectral line observations
# with KFPA
vegaskfpaconfig = """
    receiver          = 'RcvrArray18_26'
    obstype          = 'Spectroscopy'
    backend          = 'VEGAS'
    swmode           = 'tp'
    swtype           = 'none'
    swper            = 1.0
    tint              = 30
    vlow              = 0
    vhigh             = 0
    vframe            = 'lsrk'
    vdef              = 'Radio'
    noisecal          = 'lo'
    pol               = 'Circular'
    dopplertrackfreq = 25500
    bandwidth         = 187.5
    nchan             = 'low'
    deltafreq         = 0
    vegas.vpol        = 'cross'
    restfreq          = [{"restfreq":24000, "beam" : "1,2,3,4" },
                         {"restfreq":25000 , "beam" : "1" },
                         {"restfreq":23400 , "beam" : "5,6,7" } ]
"""
"""
```

Catalogs

```
# Mysource list
format=spherical
coordmode=J2000
HEAD = NAME RA DEC
Object1 09:56:16.98 +49:16:25.5
Object2 10:56:16.98 +50:16:25.5
Object3 11:56:16.98 +51:16:25.5
Object4 12:56:16.98 +52:16:25.5
```

```
# A list of HII regions
coordmode=Galactic
head= NAME GLON  GLAT vel
G350+.07 350.107 +0.079    42.2235
G351+.17 351.613   0.172   -15.553
G352-.17 352.393  -0.176   -52.227
G352-.36 353.4219 -0.3690  22.335
```

Catalogs in a script

[reference to a file]

```
Catalog("/home/astro-util/projects/myproject/mycatalog")
```

[All in a script]

```
Catalog("")  
# My source list  
format=spherical  
coordmode=J2000  
HEAD = NAME RA DEC  
Object1 09:56:16.98 +49:16:25.5  
Object2 10:56:16.98 +50:16:25.5  
Object3 11:56:16.98 +51:16:25.5  
Object4 12:56:16.98 +52:16:25.5  
"")
```

Track(“Object1”, None, 300)

scantype (“Object1”,)

pre-defined catalogs

Catalog()

Catalog(pointing)

Catalog(fluxcal)

Catalog(xband_pointing)

Catalog(qband_pointing)

Catalog(pulsars_all_GBT)

Catalog(HI_strong)

[you can include as many catalogs as you like – if names defined in later catalogs override earlier ones.]

Solar system objects names predefined

e.g. "Sun", "Moon", "Mercury", "Mars", ... "Pluto"

Ephemeris Catalog

```
FORMAT = EPHEMERIS
#
NAME = MyMovingObject
COORDMODE = J2000
VELDEF = VRAD-LSR
2004-07-16 00:10:00 09:56:16.98 +49:16:25.5 27.234234
2004-07-16 00:20:00 09:56:17.76 +49:16:36.2 27.456345
2004-07-16 00:30:00 09:56:18.55 +49:16:46.9 27.568233
2004-07-16 00:40:00 09:56:19.32 +49:16:57.6 27.623423
2004-07-16 00:50:00 09:56:20.10 +49:17:08.3 27.723456
```

Catalog("/mypath/myephemeriscatalog")

Track("MyMovingObject", None, 300)

Scan Types

Track(“3C48”, None, 60)

OnOff(“3C48”, Offset(‘J2000’, -2.0, 0.0), 60)

AutoPeakFocus()
AutoPeakFocus(“3C48”)

Balance()

Nod(“3C48”, “1”, “2”, 60)
SubBeamNod(“3C48”, 60, “MR12”, 5)

RALongMap
DecLatMap
PointMap

Track

Track(location, endOffset, scanDuration, beamName, startTime, stopTime, fixedOffset)

location : A Catalog source name or Location object. It specifies the source which is to be tracked.

endOffset : An Offset object. It moves the beam to a new position during the scan which is specified relative to the location specified in the first parameter. If no offset is desired, use None for this parameter.

scanDuration : A float. This specifies the length of the scan in seconds.

beamName : A string. It specifies the receiver beam to use for the scan. beamName can be “C”, “1”, “2”, “3”, “4” or any valid combination for the receiver you are using such as “MR12” and “MR34”. The default value for beamName is “1”.

Track, cont

Track("3C48", None, 60.0)

Track("3C48", None, 60.0, fixedOffset=Offset ('AzEl ' , 0.0 , 1.0))

Track("3C48", endOffset=Offset ('AzEl ' , 2.0 , 0.0) , 60.0 ,
fixedOffset=Offset ('AzEl ' , -1.0, 0.0))

Track("3C48", None, stopTime="2016-01-23 12:33:00")

Track("3C48", None, stopTime="12:33:00LST")

Track("3C48", None, stopTime=Horizon(10))

Script Objects

```
Location("J2000", "16:30:00", "47:23:00")
```

```
Offset("J2000", "00:30:00", "05:00:00", cosv = False)
```

```
Offset("Galactic", 182.56, 34.27, cosv = True)
```

python scripting

```
sources = [ '3C48' , '3C286' , '3C345' ]
```

```
for ss in sources :  
    Track(ss, None, 60)
```

```
c = Catalog ("/home/astro-util/astridcats/HIstrong.cat")  
sourcenames = c.keys()  
for s in sourcenames :  
    Nod( s , 120 )
```

Utility Functions

Comment()

Break()

```
while GetUTC() < 12.0 :  
    Track ("0353+2234" ,None , 600. )
```

```
while GetLST() < 13.5 :  
    Track ("1153+1107" ,None , 600. )  
Track("1712+036" ,None , 600. )
```

WaitFor ("15:13:00 LST")

WaitFor (Horizon (10.0).GetRise("1532+3421"))

Mapping: point map

```
PointMap(location, hLength, vLength, hDelta, vDelta, scanDuration,  
beamName, start, stop)
```

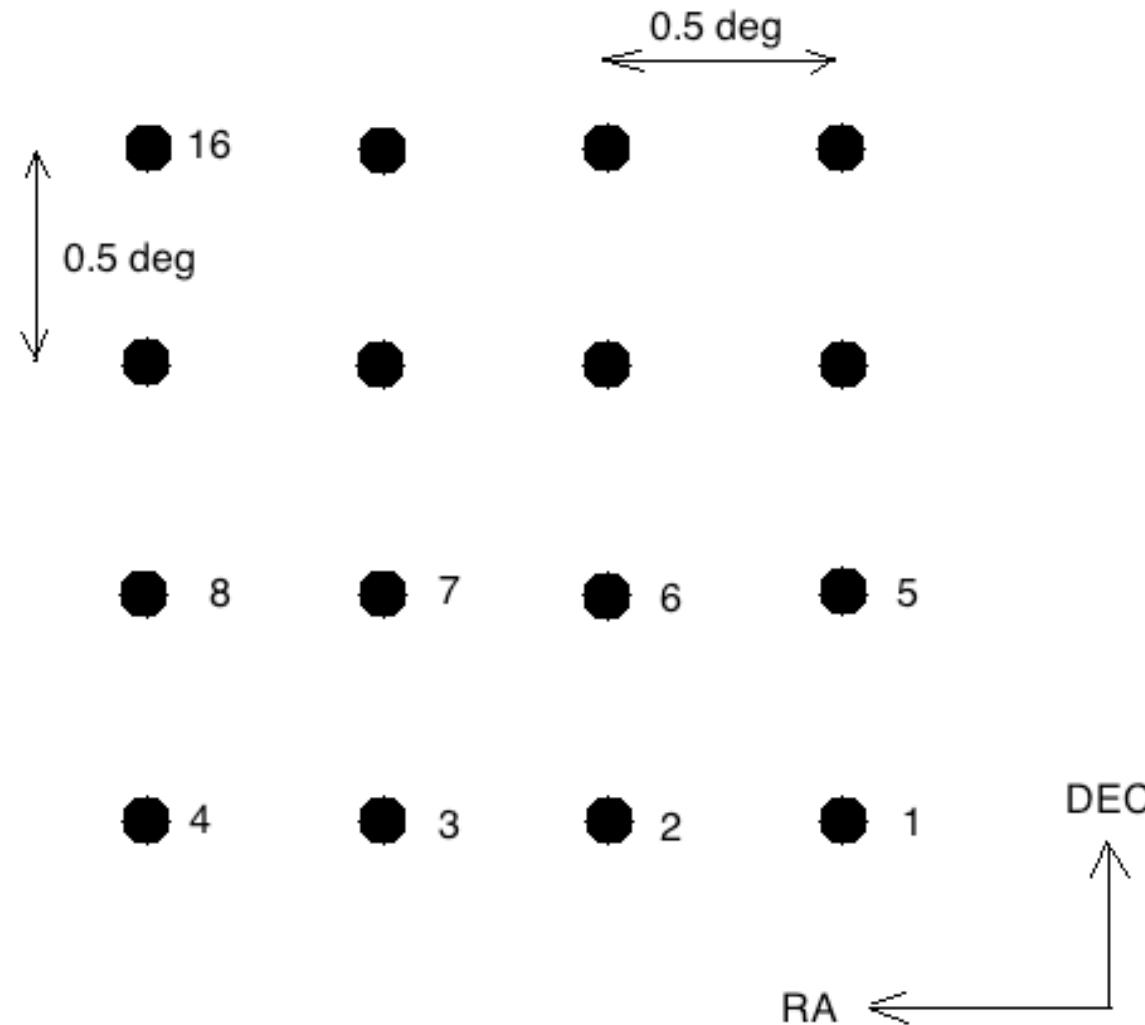
```
PointMapWithReference(location, hLength, vLength, hDelta, vDelta,  
referenceOffset, referenceInterval, scanDuration, beamName, start, stop)
```

```

PointMapWithReference("2023+2223",
    Offset("B1950", 1.50, 0.00, cosv=True),
    Offset("B1950", 0.00, 1.50, cosv=True),
    Offset("B1950", 0.50, 0.00, cosv=True),
    Offset("B1950", 0.00, 0.50, cosv=True),
    Offset("J2000", 3.00, 3.00, cosv=True),
    2,
    2.0)
# map center location
# 90 arcmin/cos(dec) size
# 90 arcmin of deg size
# 30 arcmin/cos(dec) step
# 30 arcmin step spacing
# offset reference dist
# reference every 2nd pnt
# 2 seconds per point

```

Point Map Example

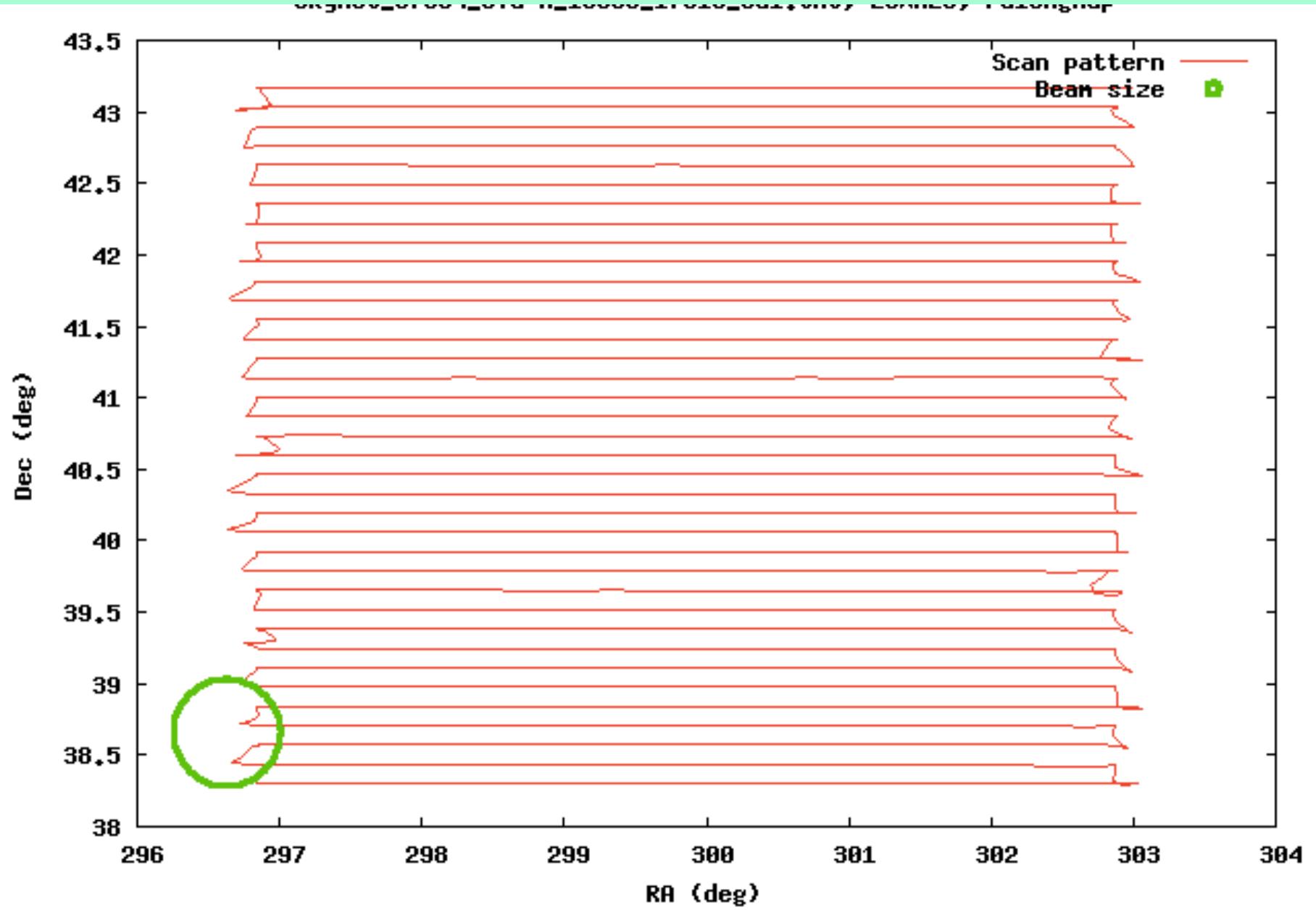


RALongMap

```
RALongMap(location, hLength, vLength, vDelta, scanDuration,  
          beamName, unidirectional, start, stop)
```

```
RALongMapWithReference(location, hLength, vLength, vDelta,  
                      referenceOffset, referenceInterval, scanDuration,  
                      beamName, unidirectional, start, stop)
```

```
RALongMapWithReference ("CygA" , # center of map  
                      Offset("J2000", 2.0, 0.0, cosv=True ), # 120'/cos(dec) width  
                      Offset("J2000", 0.0, 0.5, cosv=True ), # 30' height  
                      Offset("J2000" , 0.0, 0.1, cosv=True), # 6' vertical spacing  
                      Offset("J2000", 4.0, 4.0, cosv=True), # 4 deg/cos(dec) ref offset  
                      7, # ref every 7th row  
                      10.0) # 10 seconds per row
```

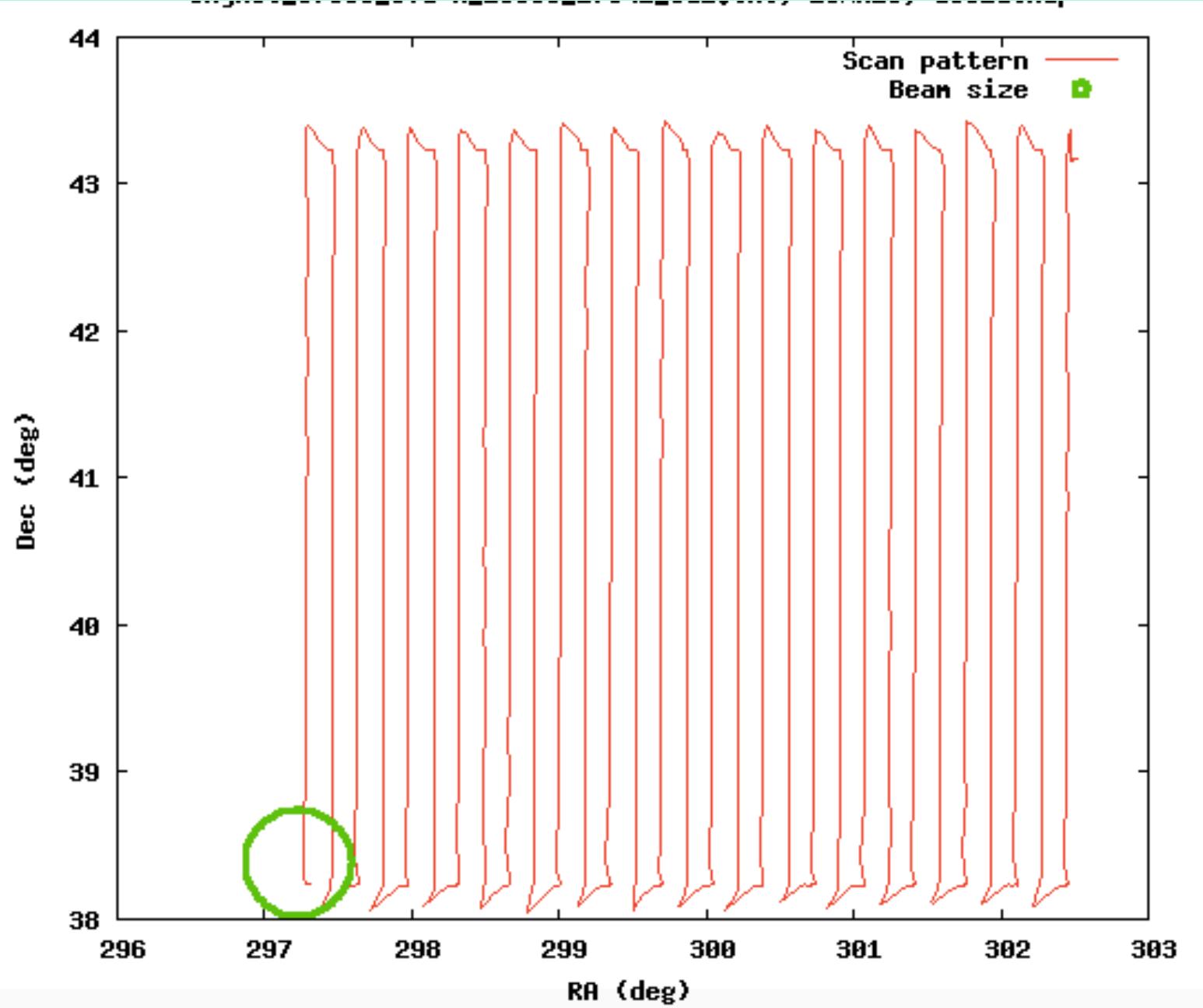


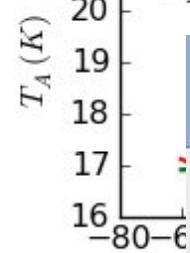
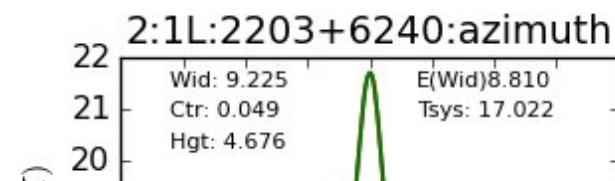
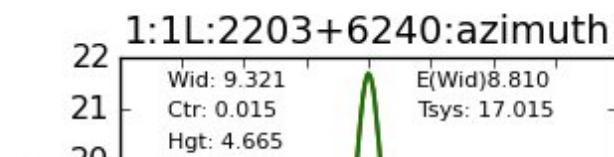
DecLatMap

```
DecLatMap(location, hLength, vLength, hDelta, scanDuration, beamName,  
          unidirectional, start, stop)
```

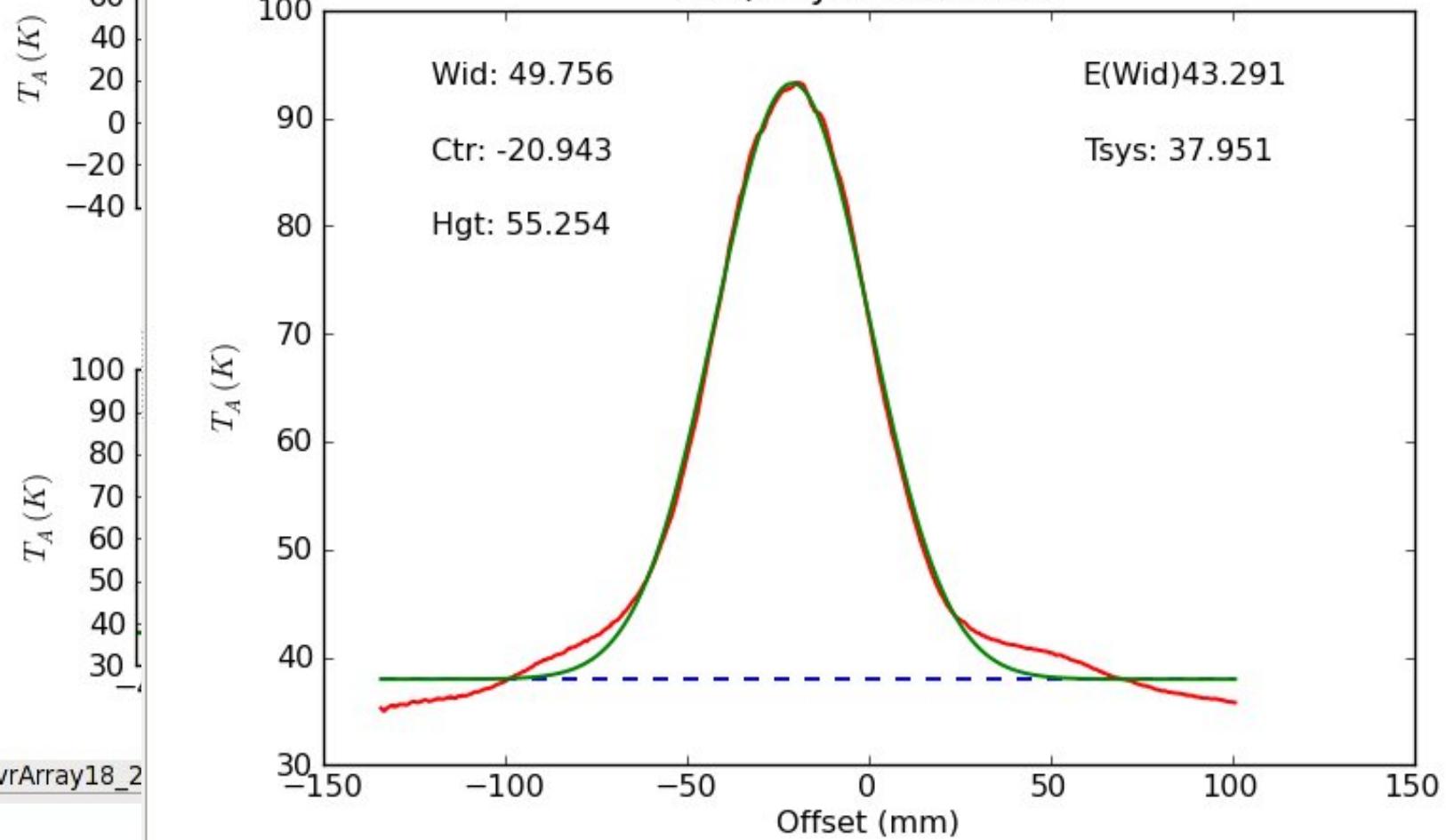
```
DecLatMapWithReference(location, hLength, vLength, hDelta,  
                      referenceOffset, referenceInterval, scanDuration, beamName,  
                      unidirectional, start, stop)
```

```
DecLatMapWithReference ("ORIONKL" , # center of map  
                         Offset("J2000", 4.8/60.0, 0.0, cosv = False ), # 4.8' wide  
                         Offset("J2000", 0.0, 12.0/60.0, cosv = False), # 12' tall  
                         Offset("J2000", 0.24/60.0, 0.0 , cosv = False), # 0.24' stripe spacing  
                         Offset("J2000", 3.0, 2.0, cosv = False), # 3,2 deg ref offset  
                         3, # ref every 3rd column  
                         10.0) # 10 seconds per row
```





9:3L/7L:JUPITER:focus



Rcvr1_2 Feeds = [

T_A (K)

RcvrArray18_2

RcvrArray18_26 Feeds = [3, 7] DualBeam Polarizations = ['XL'] Center Sky Frequency = 24.93 GHz

File Edit View Tools Help

File Edit View Tools Help



ObservationManagement - 1 DataDisplay - 1 GbtStatus - 1

Edit Run

Project:

AGBT15B_244

Scheduling Blocks:

NGC4258_KaBand

NGC4258_KaBand_point

NGC4258_KaBand_test

NGC4258_KaBand_test2

NGC4258_test

NGC4258_WbandFL1_hi

NGC4258_WbandFL1_hi_autooff

NGC4258_WbandFL1_hi_autopeakfocus

NGC4258_WbandFL1_hi_calseq

NGC4258_WbandFL1_hi_nodcal

NGC4258_WbandFL1_lo

NGC4258_WbandFL1_lo_autooff

NGC4258_WbandFL1_lo_autopeakfocus

NGC4258_WbandFL1_lo_calseq

NGC4258_WbandFL1_lo_nodcal

NGC4258_WbandFL2_hi

NGC4258_WbandFL2_hi_autooff

NGC4258_WbandFL2_hi_autopeakfocus

NGC4258_WbandFL2_hi_calseq

NGC4258_WbandFL2_hi_nodcal

NGC4258_WbandFL2_lo

NGC4258_WbandFL2_lo_autooff

NGC4258_WbandFL2_lo_autopeakfocus

NGC4258_WbandFL2_lo_calseq

NGC4258_WbandFL2_lo_nodcal

NGC4258_WbandFL3_hi

NGC4258_WbandFL3_hi_autooff

Editor: You are currently editing NGC4258_WbandFL1_hi_autopeakfocus

```
15 vlow = 0.
16 vhigh = 0.
17 vframe = "bary"
18 vdef = "Optical"
19 pol = "Linear"
20 nchan = "high"
21 iftarget = 1.5
22 *****
23
24 #Configure(vegas_nod_config)
25
26 catp = Catalog("/home/astro-util/astridcats/wband_pointing.cat")
27 catn = Catalog("/users/dpesce/N4258.cat")
28
29 #source = "J1159+2914"
30 #source = "J1153+4931"
31 #source = "J1146+3958"
32 source = "J1419+5423"
33 #source = "J0927+3902"
34 #source = "1229+0203"
35
36 Slew(source)
37 Break("Waiting for the telescope to settle.",30)
38
39 #Peak
40 #AutoPeak(source)
41
42 AutoPeakFocus(source)
```

NGC4258_WbandFL1_hi_autopeakfocus

Save to Database Delete from Database Import from File Export to File

Validation Output:

Observation State:

NotConnected

GBT State:

NotConnected

GBT Status:

NotConnected

Queue Control:

Halt Queue

Observation Control:

Pause

Stop

Abort

Interactive

Observation Log Options:

Comment Trace Sounds

Export Log

