The Current Status of the Green Bank Telescope

URSI
5 Jan 2004, Boulder CO
Telescope Structure

208 m parent (virtual) parabola

GBT 100 x 110 m Parabola Section
Unblocked Aperture
Active Surface
GBT Sensitivity

![Graph showing the sensitivity of different radio telescopes over frequency. The graph plots sensitivity (in K Jy^-1) on the y-axis and frequency (in GHz) on the x-axis. The GBT, MPI 100m, VLA, 140 Foot, Arecibo, GMRT, NRO 45m, and PdBi are compared.]
Telescope Optics
Front-end Status

PF1 PF2 L S  C  X  Ku  K  Ka  Q  W

Frequency [GHz]

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GBT Receiver System Temperatures

![GBT Receiver System Temperatures](image)

- $T_{sys}$ [K]
- Frequency [GHz]
Back-end Status

Spectroscopy

DCR, CCB, ACS

Continuum

BCPM, GBPP

Pulsar

PFS

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Current Pointing Performance

Benign Conditions: (1) Exclude 10:00 → 18:00
(2) Wind < 2.5 m/s

Blind Pointing:
(1 point/focus)
\[ \sigma_2 \approx 5 \text{ arc sec} \]
\[ \sigma(focus) \approx 2.5 \text{ mm} \]

Offset Pointing:
(90 min)
\[ \sigma_2 \approx 2.7 \text{ arc sec} \]
\[ \sigma(focus) \approx 1.5 \text{ mm} \]

Continuous Tracking:
(30 min)
\[ \sigma_2 \approx 1 \text{ arc sec} \]
Half-power Track (14 GHz)

RMS = 0.60 arcsec
GBT Sidelobes (Cygnus A @ 800 MHz)
Active Surface Performance at 20 GHz
Q band (43 GHz) Performance
GBT Observing Summary (2003)

GBT Observing Summary 2003

Percent

Astronomy  Maintenance  Tests  Lost Time

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Month

URSI  5 Jan 2004
Azimuth (40 degrees per minute)
Elevation (20 degrees per minute)
# Front-end Status

<table>
<thead>
<tr>
<th>Receiver</th>
<th>Operating Range</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime Focus 1</td>
<td>290—920 MHz</td>
<td>Commissioned</td>
</tr>
<tr>
<td>Prime Focus 2</td>
<td>910—1230 MHz</td>
<td>Commissioned</td>
</tr>
<tr>
<td>L Band</td>
<td>1.15—1.73 MHz</td>
<td>Commissioned</td>
</tr>
<tr>
<td>S Band</td>
<td>1.73—2.60 MHz</td>
<td>Commissioned</td>
</tr>
<tr>
<td>C Band</td>
<td>3.95—5.85 MHz</td>
<td>Commissioned</td>
</tr>
<tr>
<td>X Band</td>
<td>8.2—10.0 MHz</td>
<td>Commissioned</td>
</tr>
<tr>
<td>Ku Band</td>
<td>12.4—15.4 MHz</td>
<td>Commissioned</td>
</tr>
<tr>
<td>K Band</td>
<td>18—26.5 MHz</td>
<td>Commissioned</td>
</tr>
<tr>
<td>Ka Band</td>
<td>26—40 MHz</td>
<td>Under Construction</td>
</tr>
<tr>
<td>Q Band</td>
<td>40—50 MHz</td>
<td>Partially Commissioned</td>
</tr>
<tr>
<td>W Band</td>
<td>68—92 MHz</td>
<td>On Hold</td>
</tr>
<tr>
<td>Penn Array</td>
<td>86---94 MHz</td>
<td>Under Construction</td>
</tr>
</tbody>
</table>
Back-end Status: Spectroscopy

GBT Spectrometer (3 and 9-level correlator):
  Bandwidths: 12.5, 50, 200, 800 MHz
  Modes: 8 x 800 MHz; 32 x 50 MHz
  Resolution: 48 Hz @ 12.5 MHz

Spectral Processor (32 bit FT spectrometer):
  Bandwidths: 0.078125 – 40 MHz
  Modes: 2 x 1024 x 40 MHz; 8 x 256 x 10 MHz
  Resolution: 76.3 Hz @ 0.078125 MHz
Back-end Status: Continuum

Digital Continuum Receiver:
  V/F converter into 28 bit counters
  16 inputs; 10 switching phases
  100 nano-sec phase time resolution

Caltech Continuum Back-end: (under construction)
  For Ka and W-band receivers
  Full bandwidth
  10 kHz switching
Back-end Status: Pulsar

Spectrometer:
  Bandwidth: 800 MHz
  Data rate: 25 MB per second

Spectral Processor:
  Bandwidth: 40 MHz
  Pulsar timing

Berkeley Caltech Pulsar Machine (BCPM1, BCPM2):
  Bandwidth: 23 – 160 MHz

Green Bank-Berkeley Pulsar Processor (GBPP):
  Digital de-dispersion; cross pol
Back-end Status: Misc

Portable Fast Sampler: bi-static radar
Sample Rate: 20 MHz
### GBT Sensitivity (60 second integration time)

<table>
<thead>
<tr>
<th>Spectral Line Sensitivity</th>
<th>Bandwidth</th>
<th>RMS Noise</th>
</tr>
</thead>
<tbody>
<tr>
<td>1420 MHz (HI)</td>
<td>1 km/s</td>
<td>0.06 K (32 mJy)</td>
</tr>
<tr>
<td>22 GHz (H2O)</td>
<td>1 km/s</td>
<td>0.03 K (18 mJy)</td>
</tr>
<tr>
<td>43 GHz (SiO)</td>
<td>1 km/s</td>
<td>0.03 K (15 mJy)</td>
</tr>
<tr>
<td>89 GHz (HCN)</td>
<td>1 km/s</td>
<td>0.04 K (40 mJy)</td>
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<table>
<thead>
<tr>
<th>Continuum Sensitivity</th>
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</tr>
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<tbody>
<tr>
<td>14 GHz</td>
<td>3 GHz</td>
<td>55 micro-Jy</td>
</tr>
<tr>
<td>90 GHz</td>
<td>7 GHz</td>
<td>270 micro-Jy</td>
</tr>
<tr>
<td>90 GHz</td>
<td>20 GHz</td>
<td>120 micro-Jy</td>
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