ARO EQUIPMENT SUMMARY AND STATUS

12M Telescope (EIE ALMA Prototype Antenna) – Kitt Peak
July 30 2019

12 Meter Diameter; f/8
Observing season: October – June
Carbon fiber construction
Altitude over Azimuth
Absolute pointing accuracy: 2.5” rms
Tracking precision: 0.2” rms
Efficiency: 85% +/- 5%
Azimuth range: +/-270°
Elevation range: 3° to 110°
Observational range: ~18° – 84°
Slew speed: 360° min⁻¹
Observational value: 60° min⁻¹
(Dome tracking limited)
Supports position-switching, beam-switching, on-the-fly mapping, and continuum observing

Front Ends
Multi-Band Receiver (4mm, 3mm, 2mm, 1mm, Dual polarization, SBS)
3mm (ALMA Band 3; 84 – 116 GHz; Available)
  Image Rejection: 15 dB minimum ≥ 20 dB typical
  Typical T_{sys@90GHz} = 120–160 K, T_{sys@115GHz} = 250–375 K
  Best T_{sys@90GHz} = 85–110 K, T_{sys@115GHz} = 150–200 K
4mm (66 – 90 GHz; Available, shared–risk)
1mm (211 – 275 GHz; Available, shared–risk)
2mm (In development)

Back Ends
ARO Wideband Spectrometer (AROWS)
Interim: two 4 GHz wide IFs (Available)
Final: four 4 GHz wide IFs (Unavailable)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Total Bandwidth (MHz)</th>
<th>Channel Spacing (kHz)</th>
<th>Velocity Resolution at 86 GHz (km s⁻¹)</th>
<th>Velocity Resolution at 115 GHz (km s⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4000</td>
<td>625</td>
<td>4.4</td>
<td>3.2</td>
</tr>
<tr>
<td>1</td>
<td>2000</td>
<td>312.5</td>
<td>2.2</td>
<td>1.6</td>
</tr>
<tr>
<td>2</td>
<td>1000</td>
<td>156.25</td>
<td>1.1</td>
<td>0.8</td>
</tr>
<tr>
<td>3</td>
<td>500</td>
<td>78.125</td>
<td>0.54</td>
<td>0.40</td>
</tr>
<tr>
<td>4</td>
<td>250</td>
<td>39.0625</td>
<td>0.28</td>
<td>0.20</td>
</tr>
<tr>
<td>5</td>
<td>125</td>
<td>19.53</td>
<td>0.14</td>
<td>0.10</td>
</tr>
</tbody>
</table>

12 Meter MAC (2 IF Mode; Available)
Center frequency fixed at 6.3 GHz in receiver IF.

<table>
<thead>
<tr>
<th>Bandwidth (MHz)</th>
<th>Channels</th>
<th>Usable (MHz)</th>
<th>Usable Channels</th>
<th>(\Delta v^*) (kHz)</th>
<th>Resolution (kHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>2048</td>
<td>600</td>
<td>1536</td>
<td>390.6</td>
<td>781.2</td>
</tr>
<tr>
<td>800</td>
<td>4096</td>
<td>600</td>
<td>3072</td>
<td>195.3</td>
<td>390.6</td>
</tr>
<tr>
<td>400</td>
<td>4096</td>
<td>300</td>
<td>3072</td>
<td>97.6</td>
<td>195.3</td>
</tr>
<tr>
<td>400</td>
<td>8192</td>
<td>300</td>
<td>6144</td>
<td>48.8</td>
<td>97.6</td>
</tr>
<tr>
<td>200</td>
<td>8192</td>
<td>150</td>
<td>6144</td>
<td>24.4</td>
<td>48.8</td>
</tr>
<tr>
<td>200</td>
<td>16384</td>
<td>150</td>
<td>12288</td>
<td>12.2</td>
<td>24.4</td>
</tr>
<tr>
<td>100</td>
<td>16384</td>
<td>75</td>
<td>12288</td>
<td>6.1</td>
<td>12.2</td>
</tr>
<tr>
<td>100</td>
<td>32768</td>
<td>75</td>
<td>24576</td>
<td>3</td>
<td>6.1</td>
</tr>
</tbody>
</table>

*This is the frequency sampling interval, not the FWHM channel width.

For more information, please contact:
Dr. H. Alyson Ford, Manager, Radio Telescopes
alysonford@email.arizona.edu

Observing Restrictions
Sun Avoidance: The 12m requires a 10° Sun avoidance zone.
Observing: On-the-fly mapping is currently unavailable with the MAC back end.
ARO EQUIPMENT SUMMARY AND STATUS
Submillimeter Telescope (SMT) – Mt. Graham
July 30 2019

Front Ends

**1.3mm Receiver (Available)**
- ALMA Band 6 (205 – 280 GHz)
- Dual polarization, SBS
- Typical $T_{sys}@230\text{GHz}= 200–275 \text{ K}$
- Best $T_{sys}@230\text{GHz}= 130–160 \text{ K}$

**0.8mm Receiver (Available)**
- 325 – 370 GHz
- Dual polarization, DSB
- Typical $T_{sys}@345\text{GHz}= 600–900 \text{ K}$
- Best $T_{sys}@345\text{GHz}= 350–500 \text{ K}$

**0.4mm Receiver (Unavailable)**
- 602 – 720 GHz
- Dual polarization, DSB
- $80 \text{ K } T_{Rx}$

**0.7mm Receiver (Unavailable)**
- 385 – 500 GHz
- Dual polarization, SBS
- $150 \text{ K } T_{Rx}$

**New 0.8mm Band 7 Receiver (In development)**
- ALMA Band 7 (275 – 373 GHz)
- Dual polarization, SBS

Back Ends

**SMT Filter banks (Available)**
The SMT IF range is 4–8 GHz for all receivers except the 0.8mm receiver, which has an IF range of 4–6 GHz. The IF center frequency is tunable from 4.5–7.5 GHz.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Bandwidth (MHz)</th>
<th>Resolution (kHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 IF</td>
<td>2000</td>
<td>1000</td>
</tr>
<tr>
<td>2 IF</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>2 IF</td>
<td>256</td>
<td>250</td>
</tr>
<tr>
<td>4 IF</td>
<td>512</td>
<td>1000</td>
</tr>
<tr>
<td>4 IF</td>
<td>128</td>
<td>250</td>
</tr>
</tbody>
</table>

Observing Restrictions

Sun Avoidance: The SMT requires a 45° Sun avoidance zone.

Observing: None.

For more information, please contact:
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alysonford@email.arizona.edu
12M Telescope (EIE ALMA Prototype Antenna) – Kitt Peak

MAC: Unusable for on-the-fly mapping due to hardware limitations.

Submillimeter Telescope (SMT) – Mt. Graham

Filters 1.0MHz: There are periods of instability in the IF down conversion stages that manifests itself in platforming. Problems appear worse in position-switching and on-the-fly observing modes.

Filters 250kHz: The instability noted in the 1.0 MHz filters also appears in these filters. This platforming step is located at the IF center frequency and can be avoided by offsetting the IF.

Position-switching mode: There is a standing wave present when using observing in position-switching mode, especially at the upper end of 1.3mm receiver observing band. This standing wave is not atmospherically induced but instead is related to the receiver/hardware.

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