

The Allen Telescope Array at the Hat Creek Radio Observatory: Overview and Status



Dave DeBoer, SI

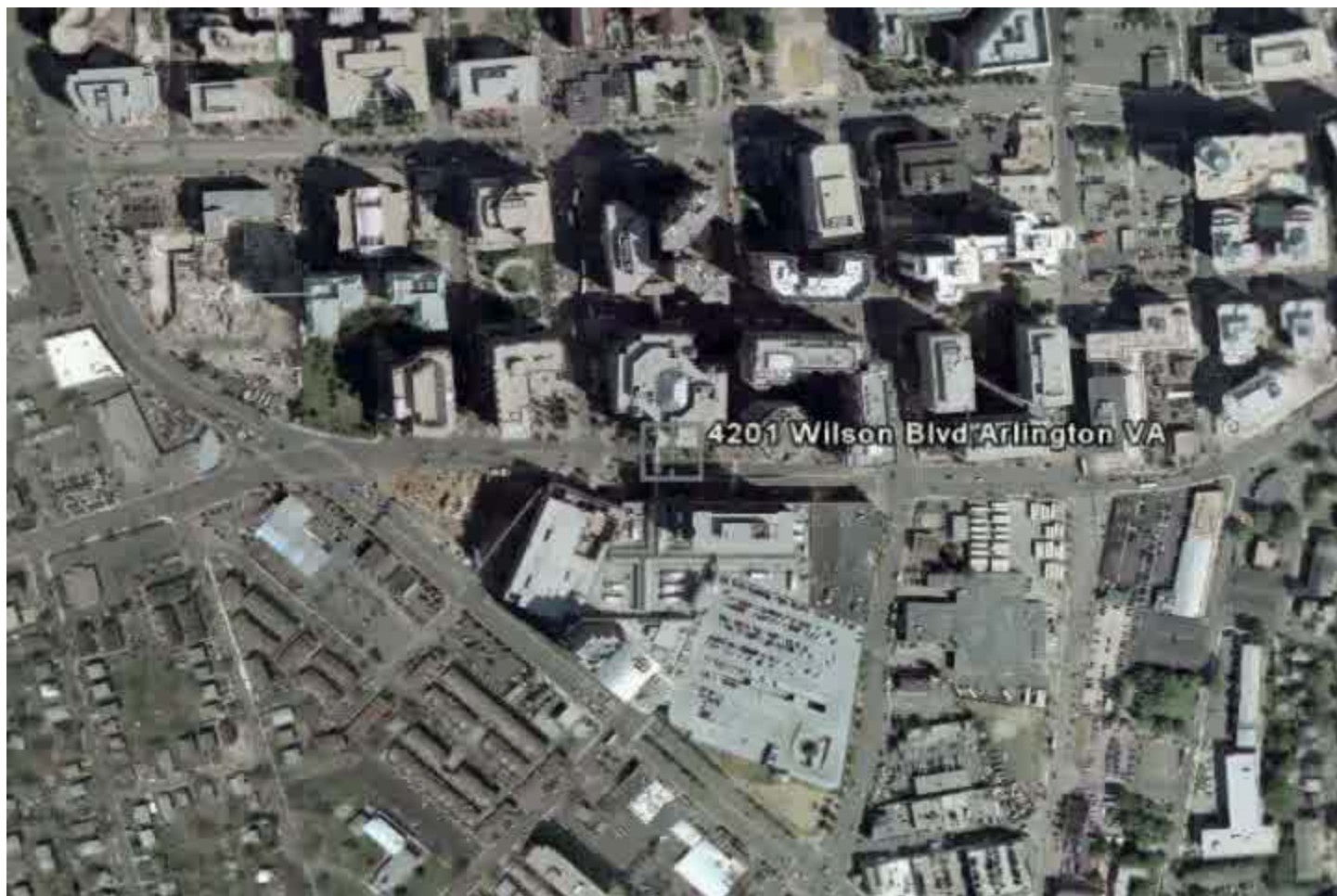
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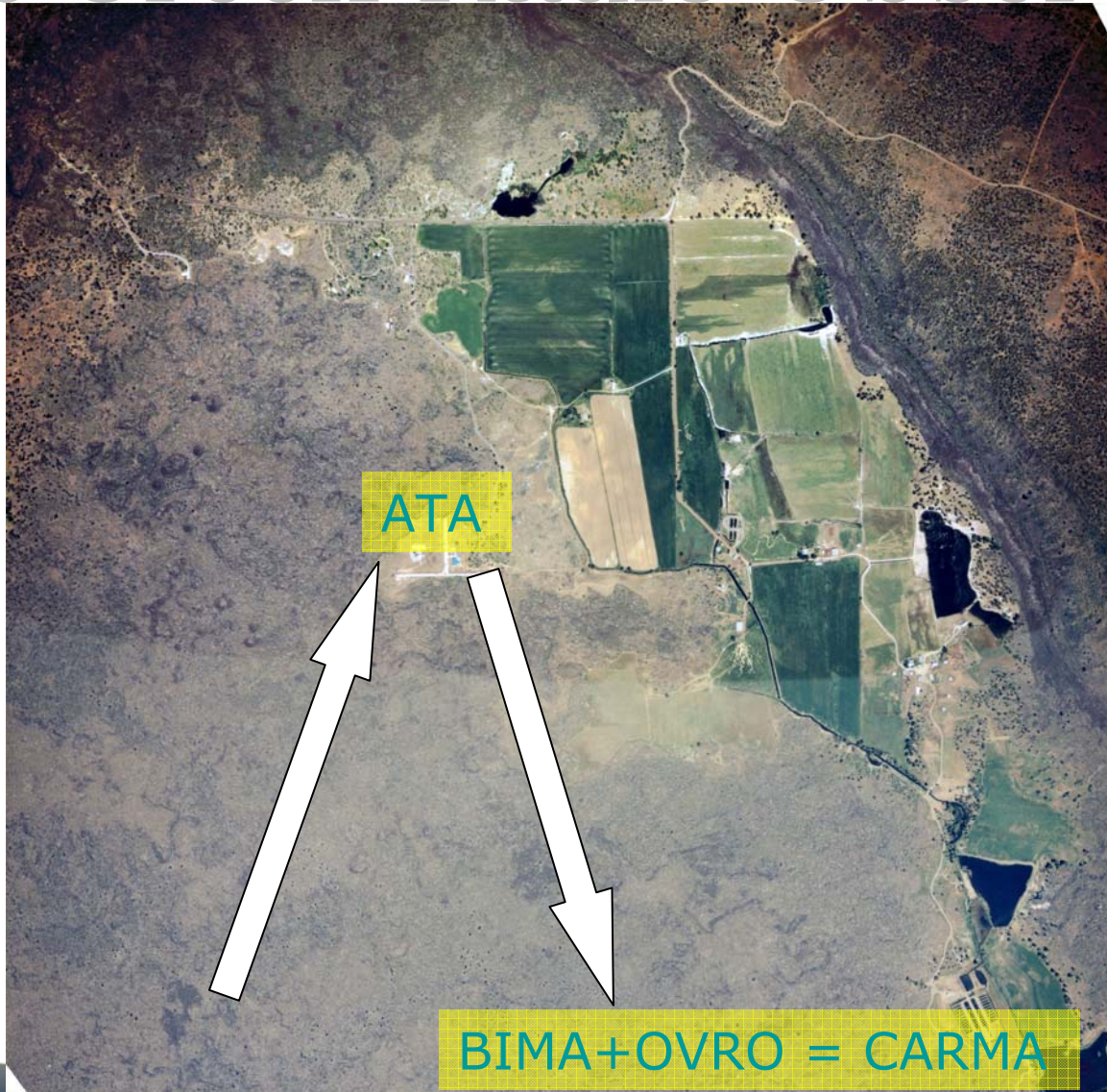
Telescope



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Hat Creek Radio Observatory



Array



Telescope



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Construction Tent



Dish Assembly



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Telescope



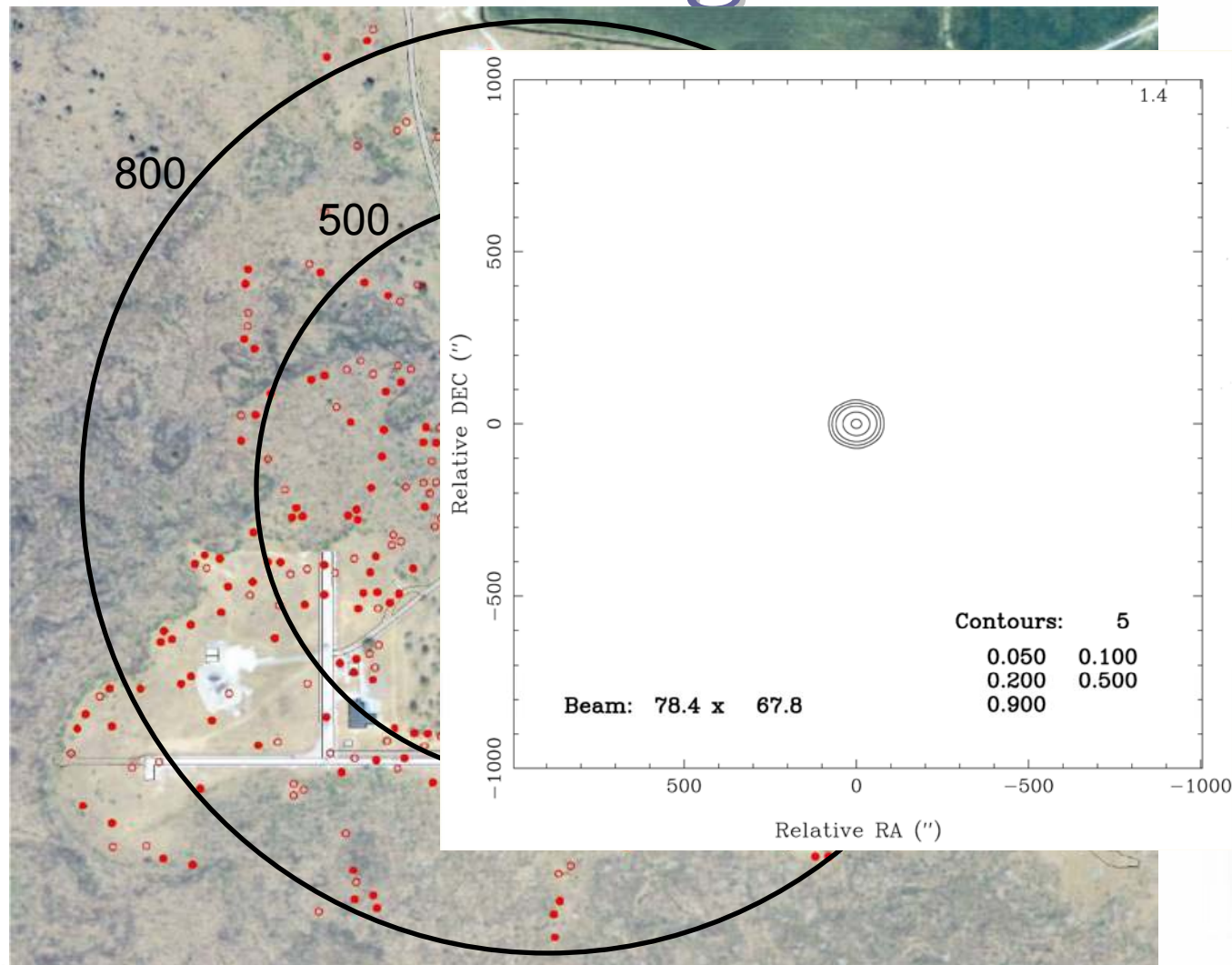
Array







ATA-350 Configuration



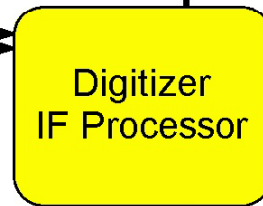
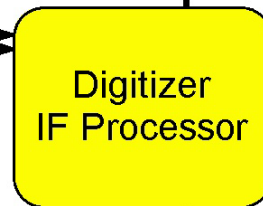
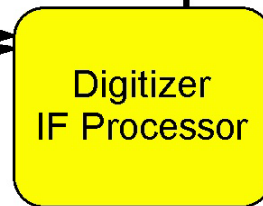
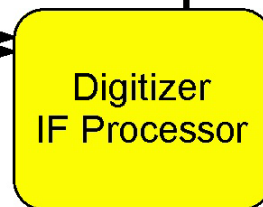
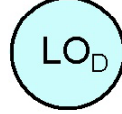
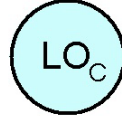
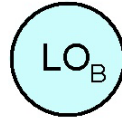
Signal Path

Field

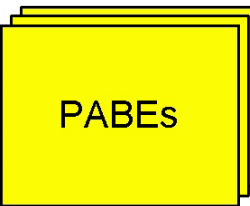
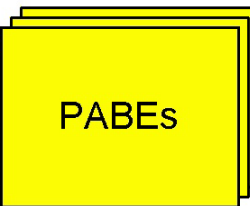
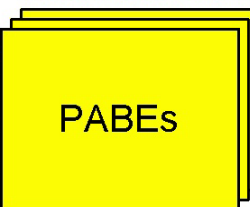


RF: 0.5 - 11 GHz

Lab



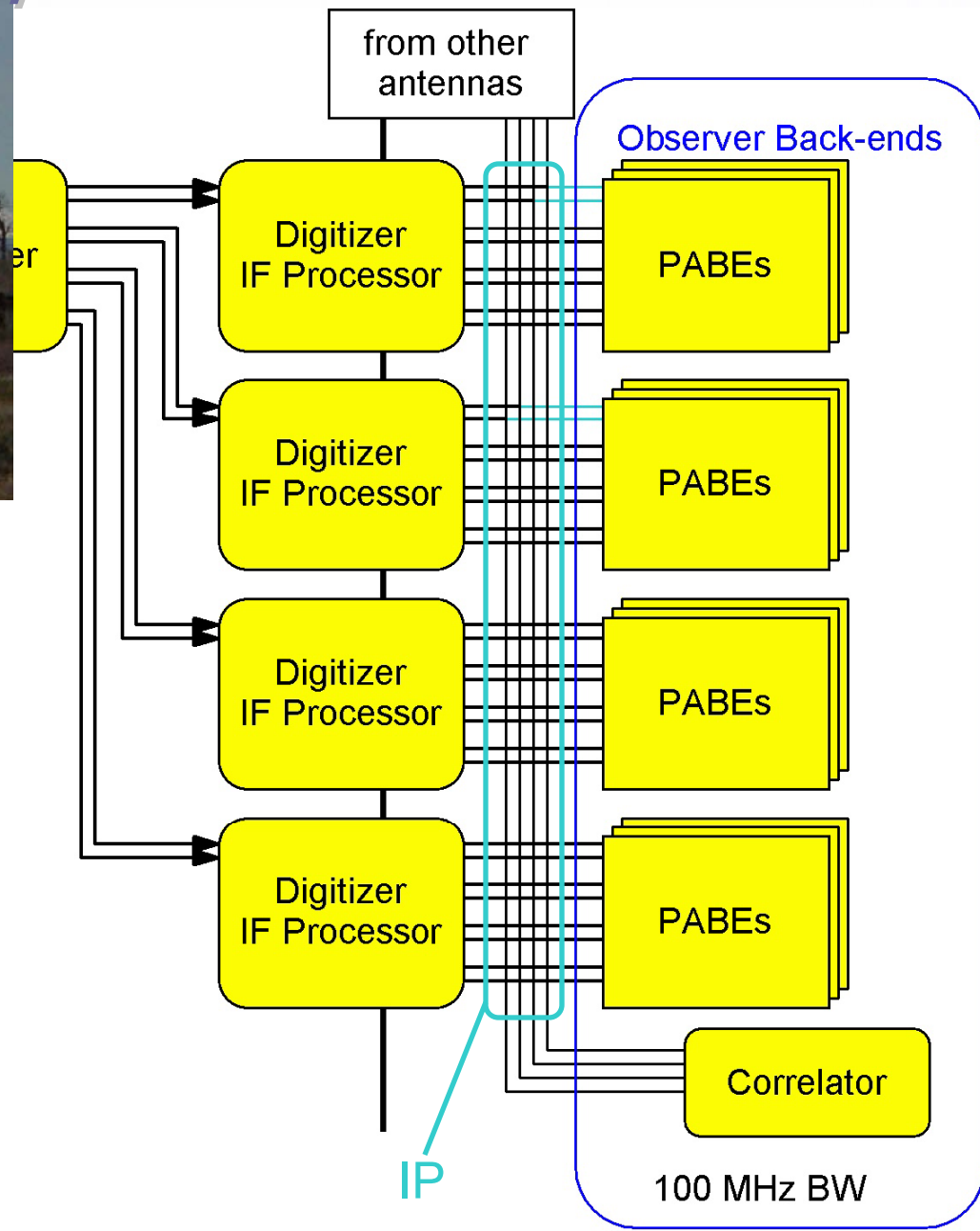
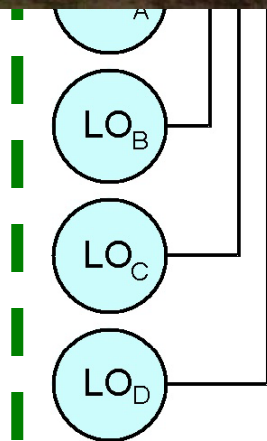
Observer Back-ends



100 MHz BW

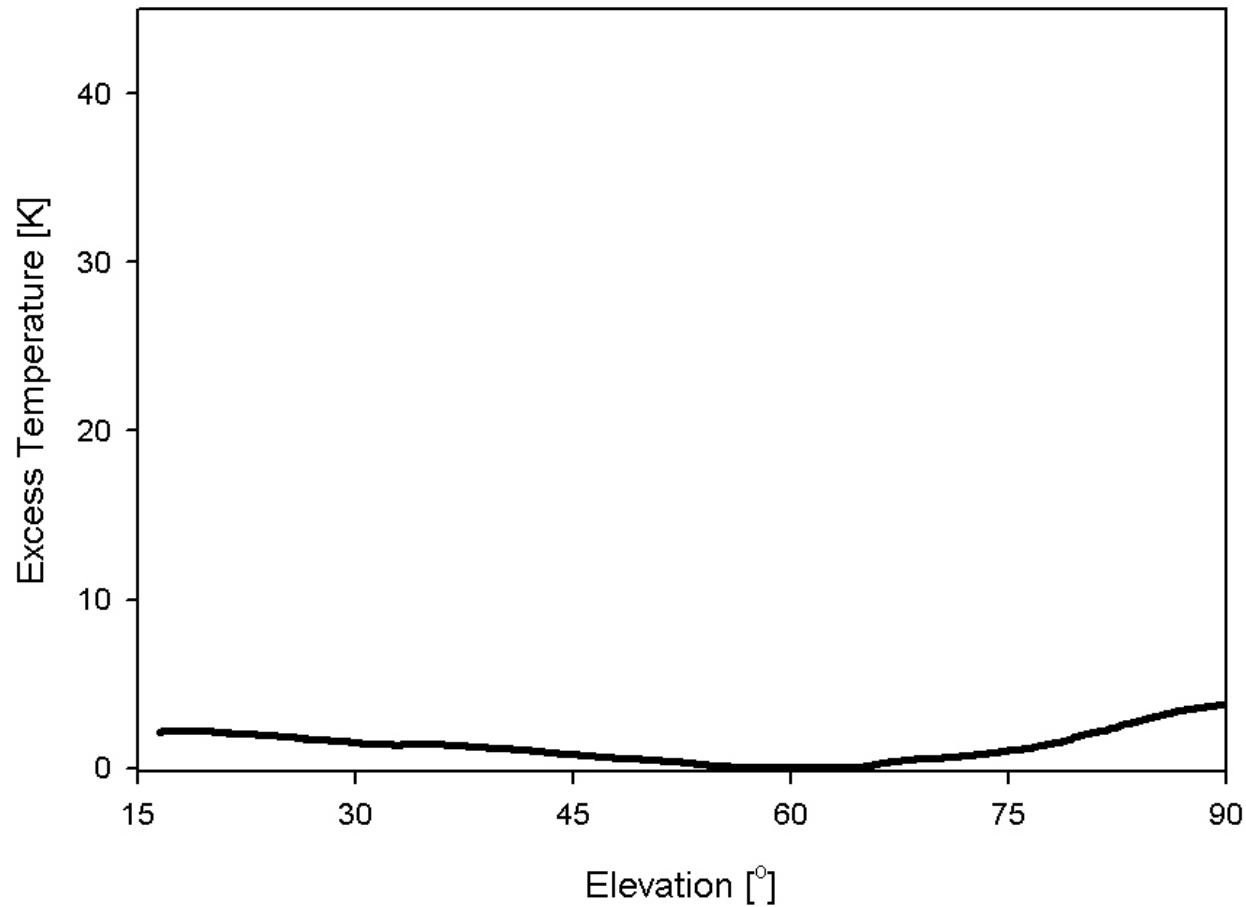
IP

Antenna/Front-end



Tip Curve

ATA Tip Curve:



Array

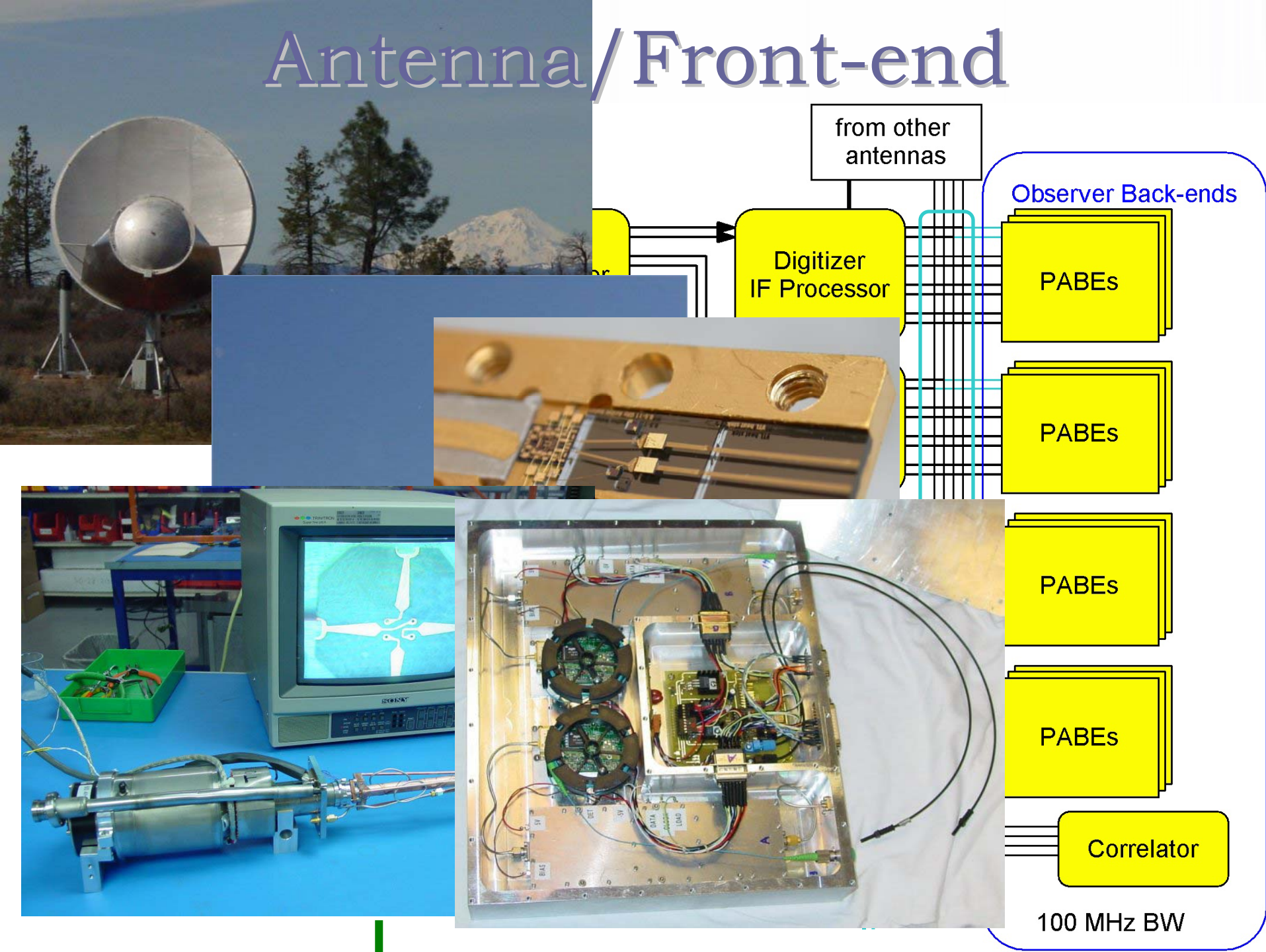


Telescope

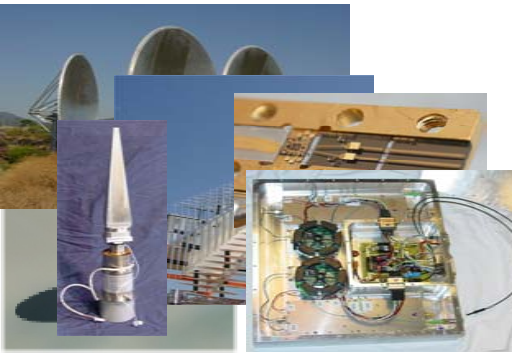


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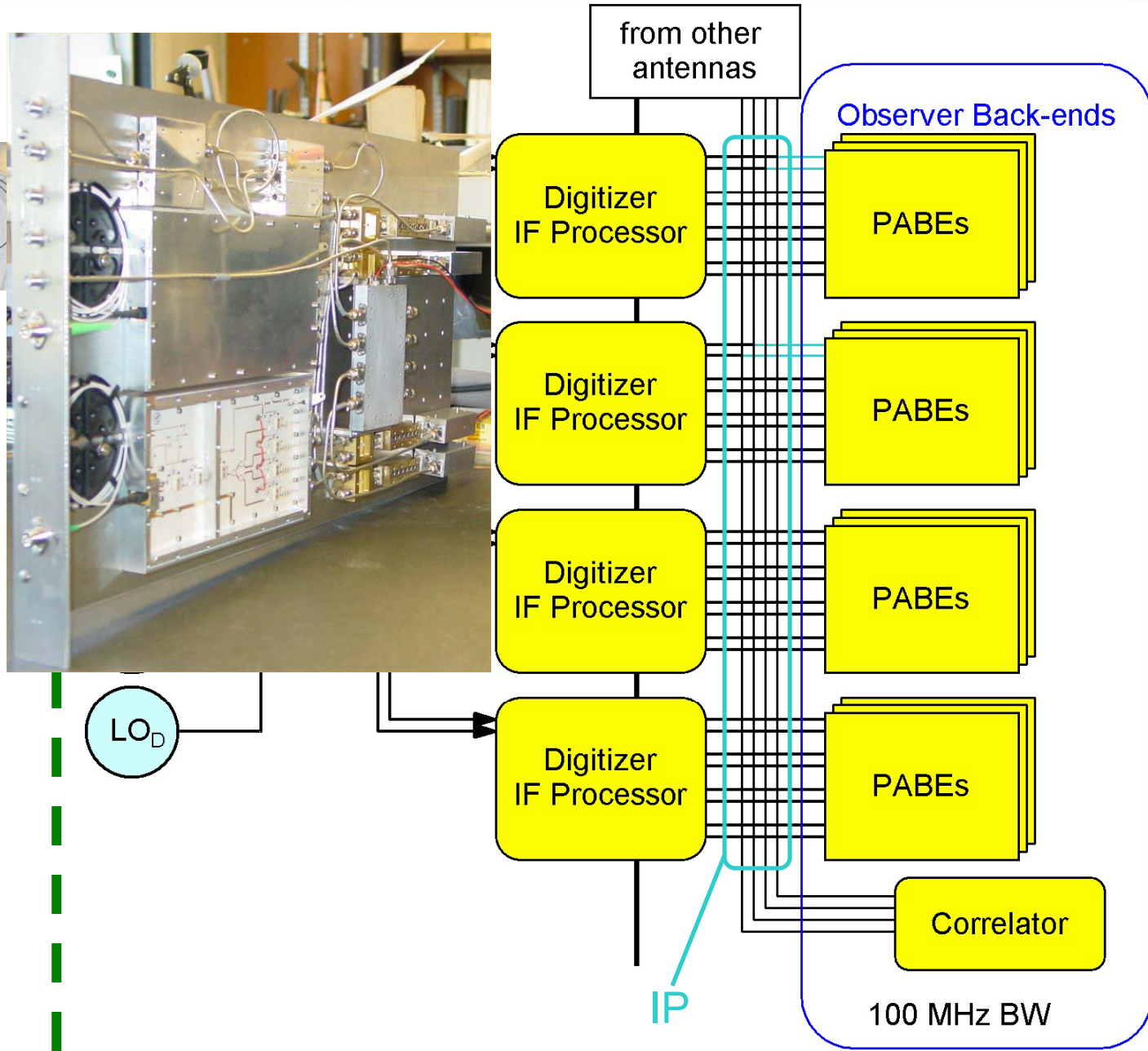
Antenna/Front-end



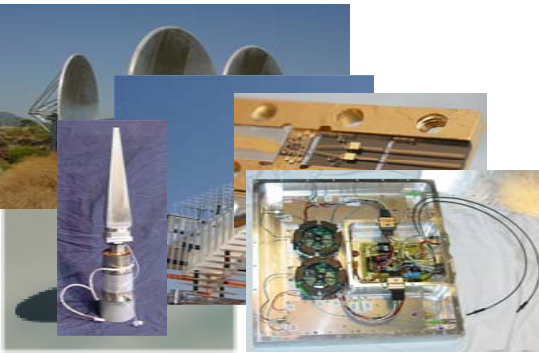
RF Converter



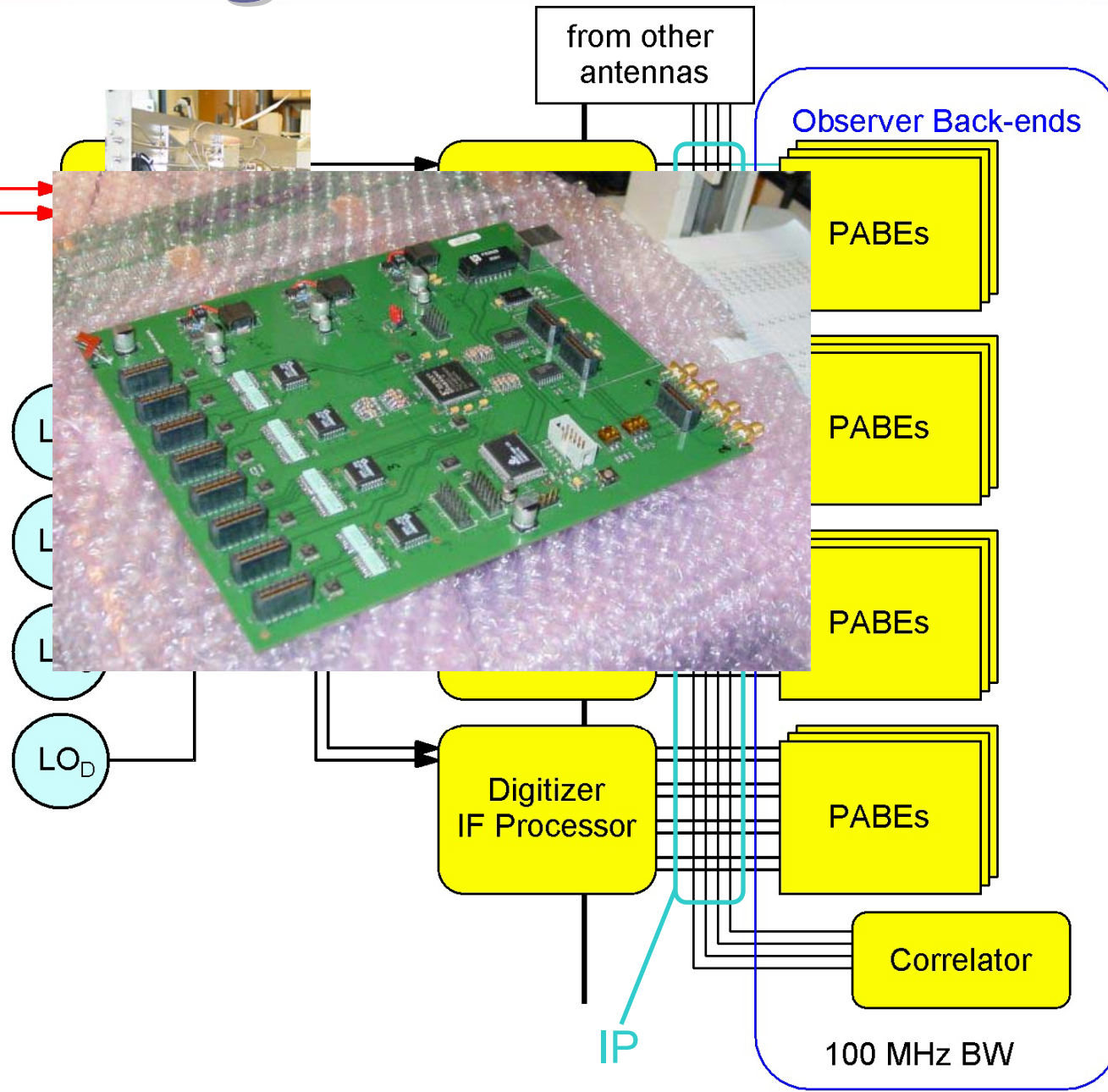
RF: 0.5 - 11 GHz



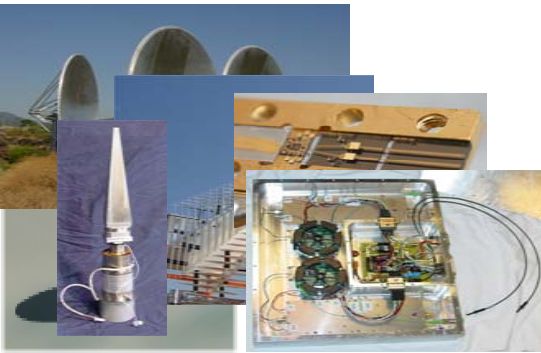
Digitizer



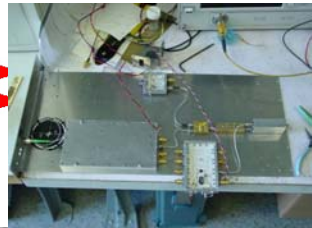
RF: 0.5 - 11 GHz



IF Processor

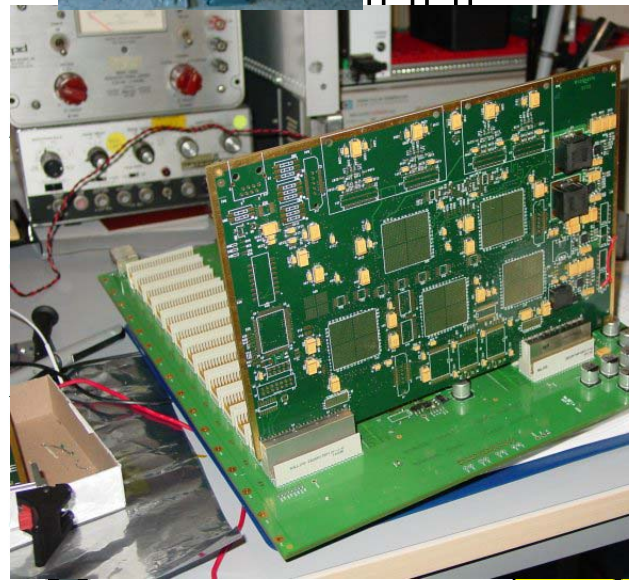


RF: 0.5 - 11 GHz



from other
antennas

Observer Back-ends



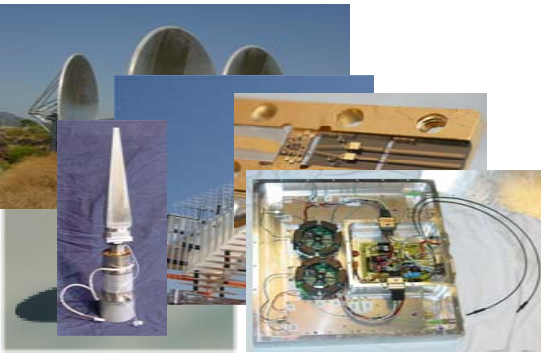
IF Pro



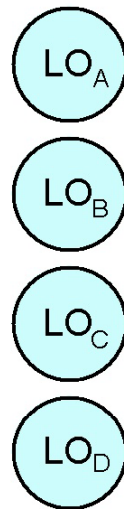
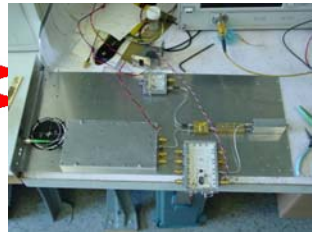
IP

100 MHz BW

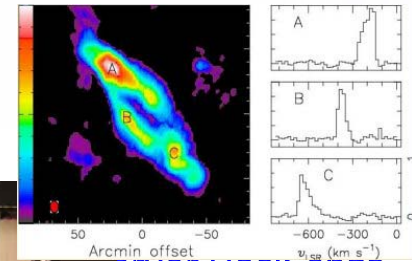
Back-ends



RF: 0.5 - 11 GHz



from other



server back-ends

ABEs

BEs



Pol: L Center Freq: 8439.318739 MHz Subband: 2006 Half Frame #: 0128 Cursor Freq: 8439.318417 MHz Bi

ATA Innovation

1. **Log-Period Antenna**
Inventors: Greg Engargiola, Wm. J. Welch (B02-033)
Patent # US6677913 **granted**
2. **Log-Period Antenna II**
Inventors: Greg Engargiola, Wm. J. Welch (B03-082)
Patent # Pending (Filing #10/683,259)
3. **Connections and Feeds for Broadband Antennas**
Inventors: Greg Engargiola (B04-113)
Patent # Pending (Filing #10/868,677)
4. **A Broadband Electromagnetic Match for a Vacuum Dewar Window**
Inventors: Wm. J. Welch (B05-073)
Patent # Disclosure filed with UCB OTL 2/13/05
5. **Offset Gregorian Radio Antenna with Protective Shroud**
Inventors: Wm. J. Welch (B05-072)
Patent # Pending (Filing #)
6. **A Switch Based Corner Turner**
Inventors: Wilbert Lynn Urry (B05-065)
Patent # Disclosure filed with UCB OTL 1/14/05
7. **Anti-backlash Reduction Gear Concept**
Inventors: Matt Fleming (B05-080)
Patent # Pending (Filing #)
8. **Reflector Support Concept Featuring a One Piece Dish Supported at the Rim by Multiple Struts and a Flexible Center Plate**
Inventors: Matt Fleming (B05-079)
Patent # Disclosure filed with UCB OTL 3/14/05
9. **Log-Periodic Antenna with Integrated Taperline Balun and Log-Periodic Channelizer**
Inventors: Greg Engargiola, Adrian Lee (B05-071)
Patent # Pending (Filing #) (With NSF)

Array

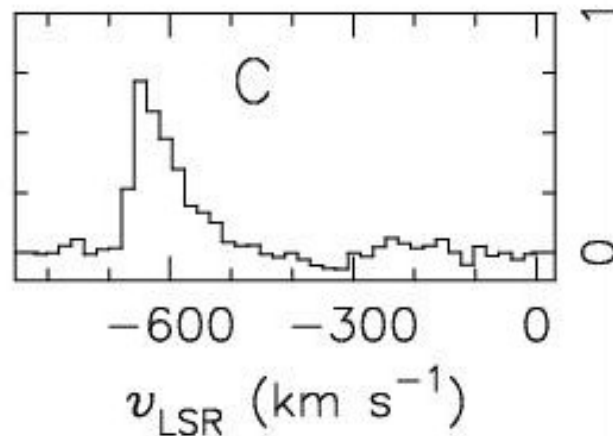
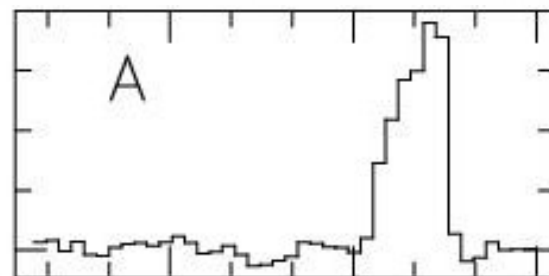
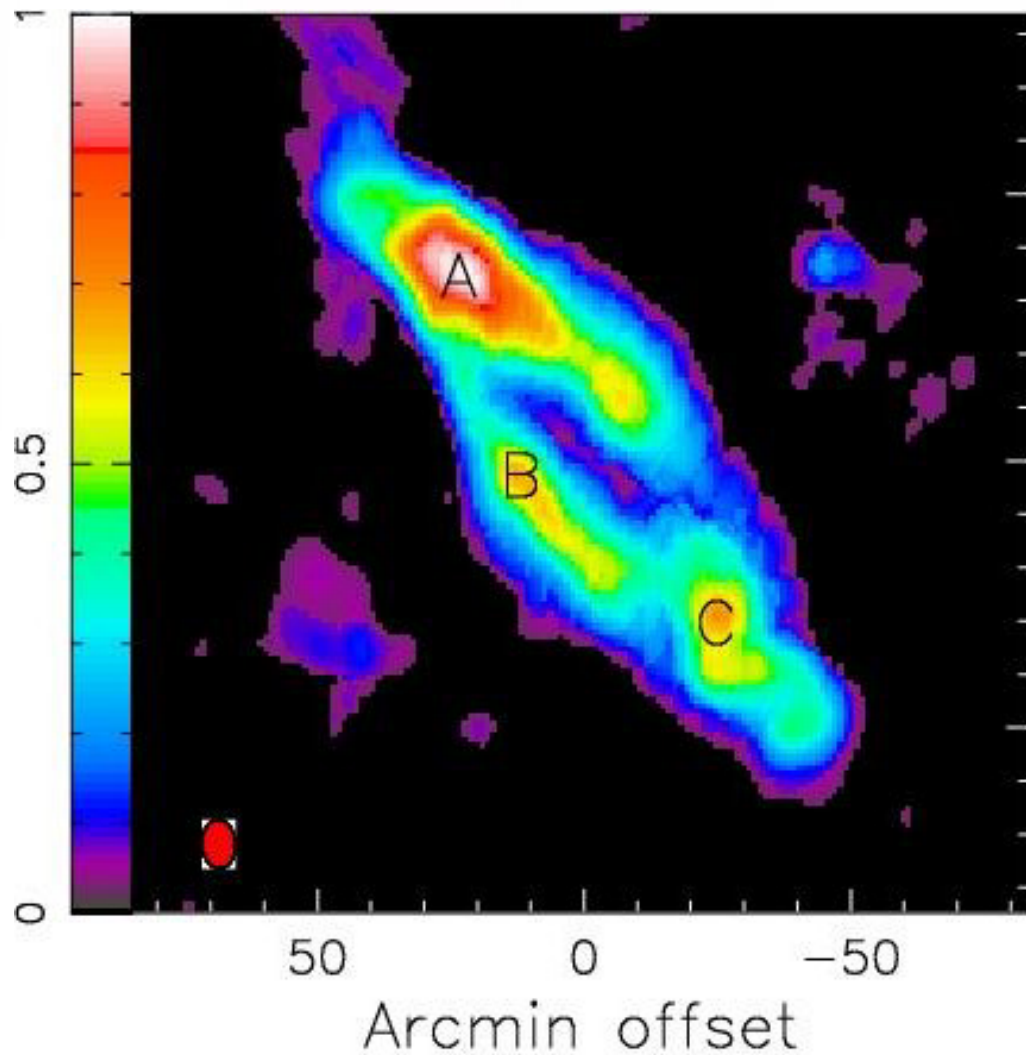


Telescope



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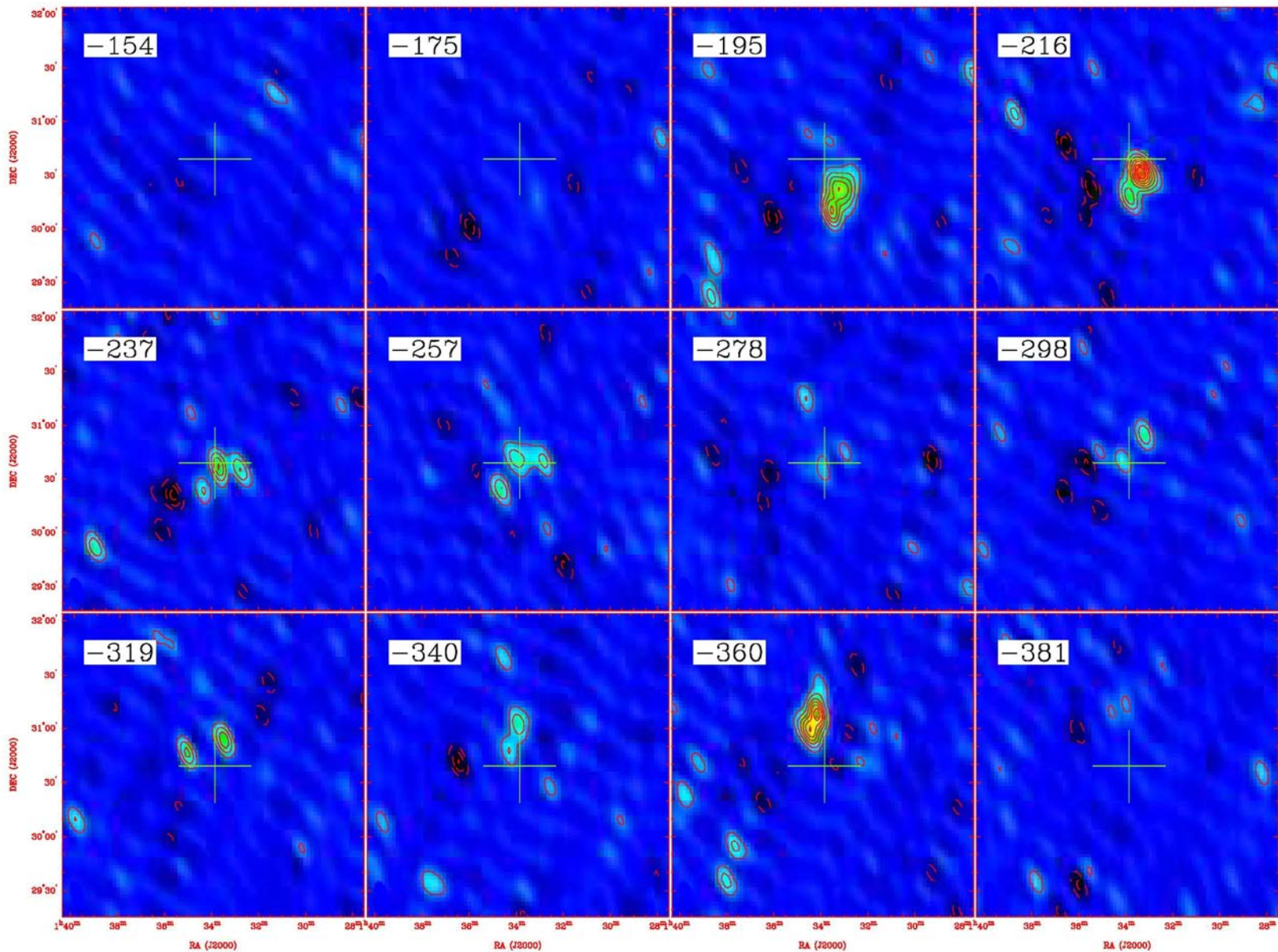
Array



Telescope



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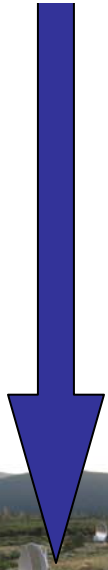
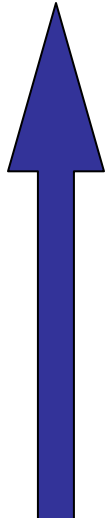


Original “Nebula”

1420 MHz



2.5°



Array



Telescope



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ATA-350

sampled 1hr intervals over 8 hours



Array



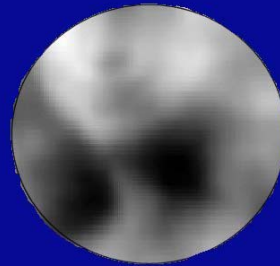
Telescope



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VLA-D

sampled 1 hr intervals over 8 hours



Array



Telescope



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ATA-32

sampled 1 hr intervals over 8 hours



Array

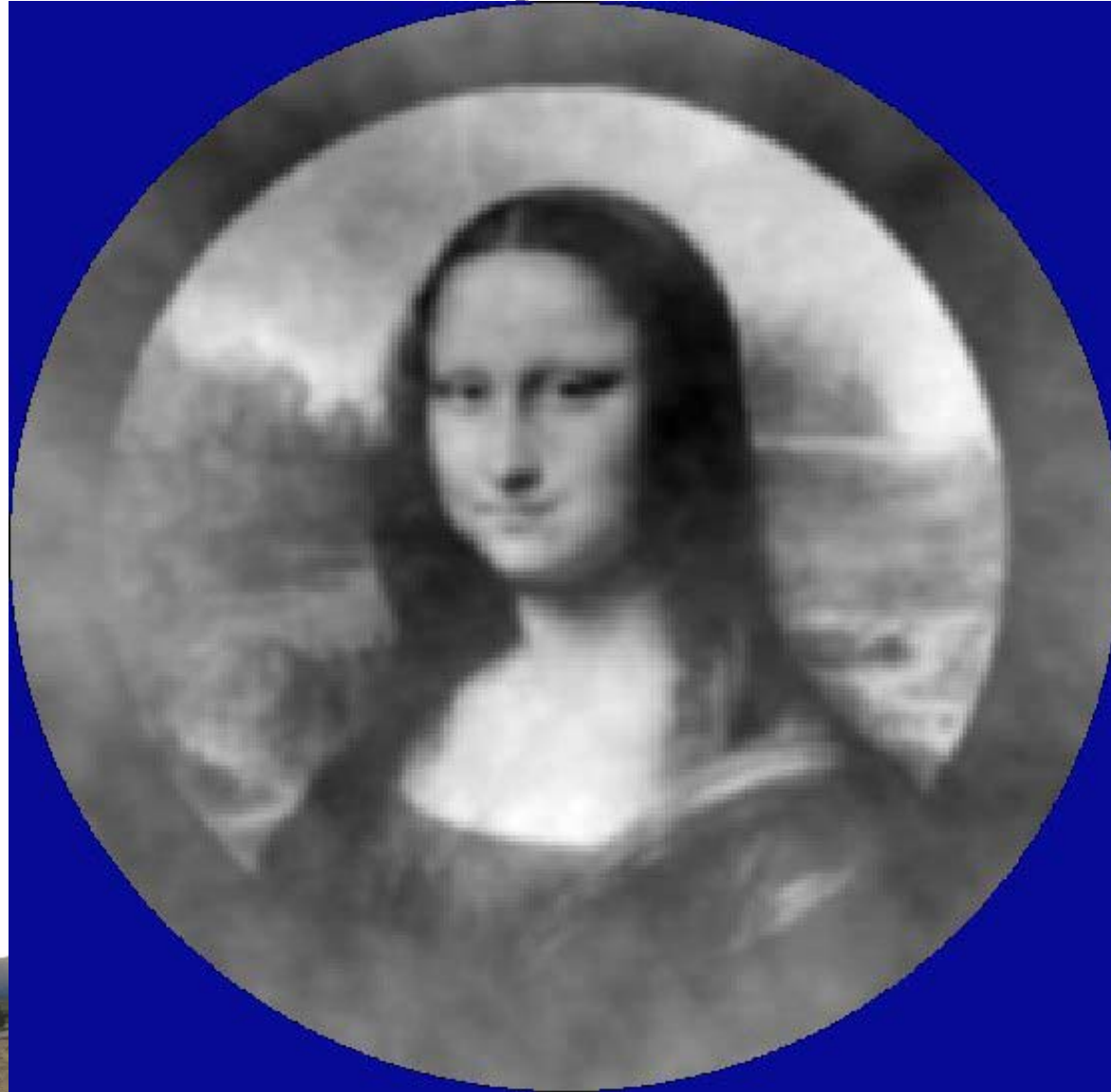


Telescope



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ATA-350 snapshot



Array

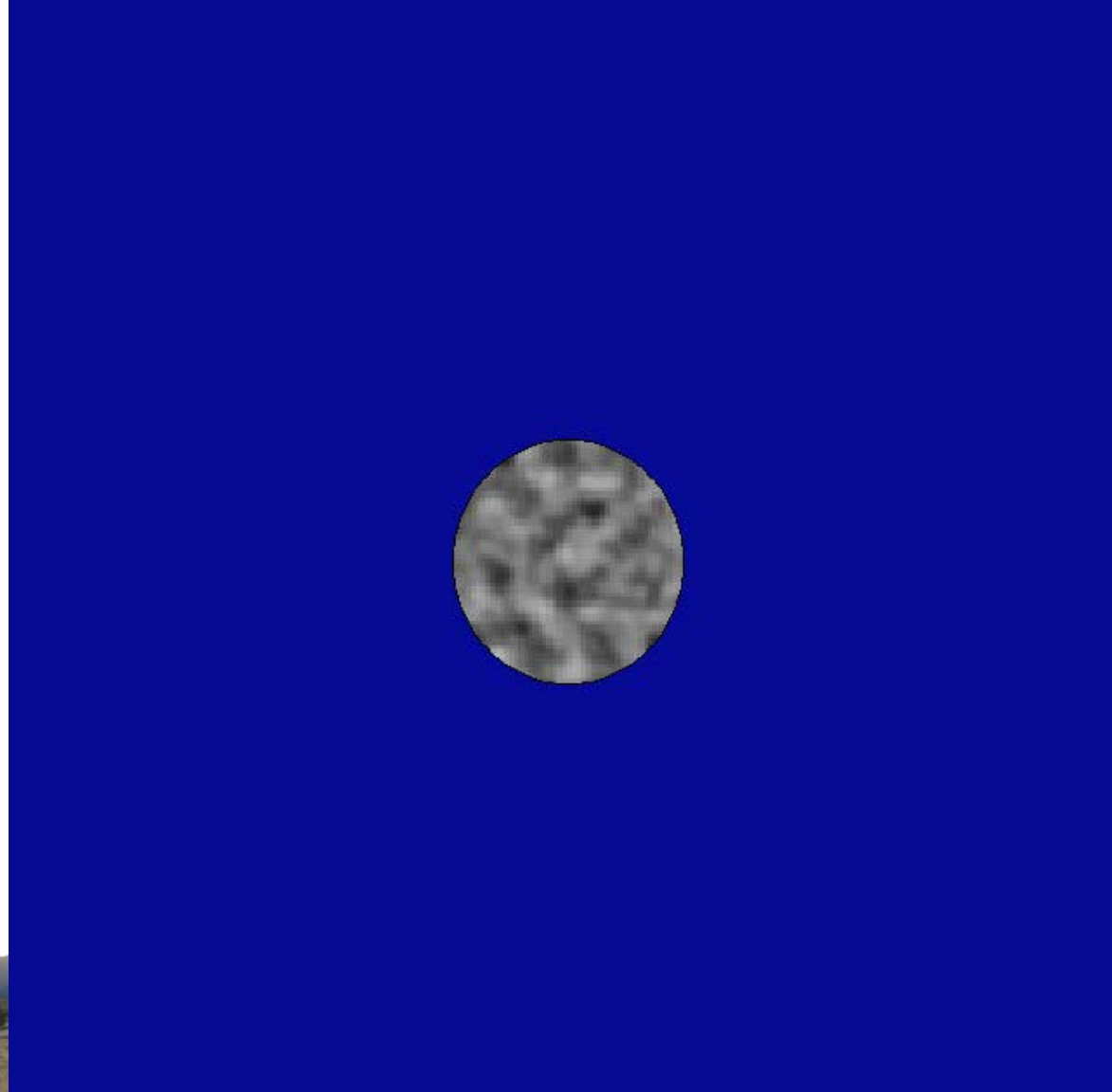


Telescope



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VLA-E snapshot



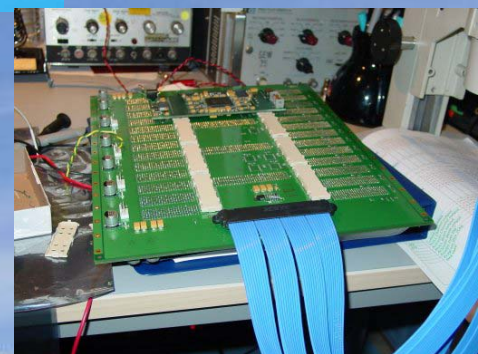
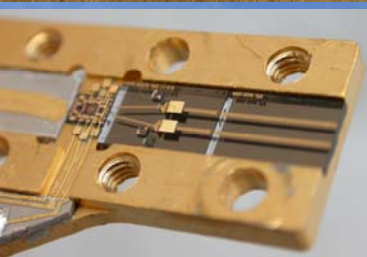
Array



Telescope



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Backup Slides

Array



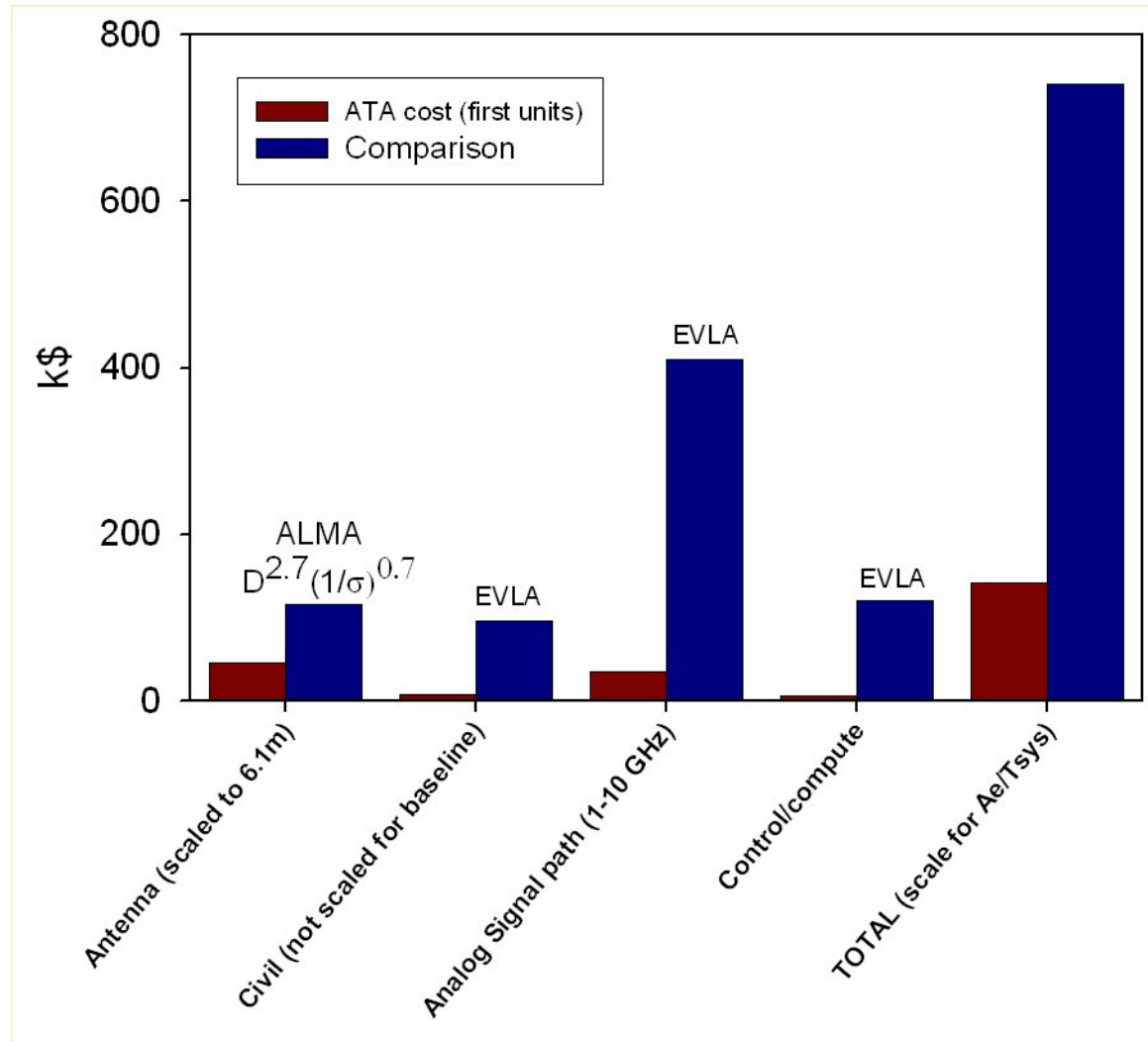
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Cost Comparison





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The following components may be used to construct descriptors that denote data streams or hardware through which data streams pass:

zone (1-35)
 element (a-m)
 polarization (X|Y)
 tuning (A|B|C|D)
 delay set (1-4)

For example:

13fXB3 refers to a unique data stream on an IFP card

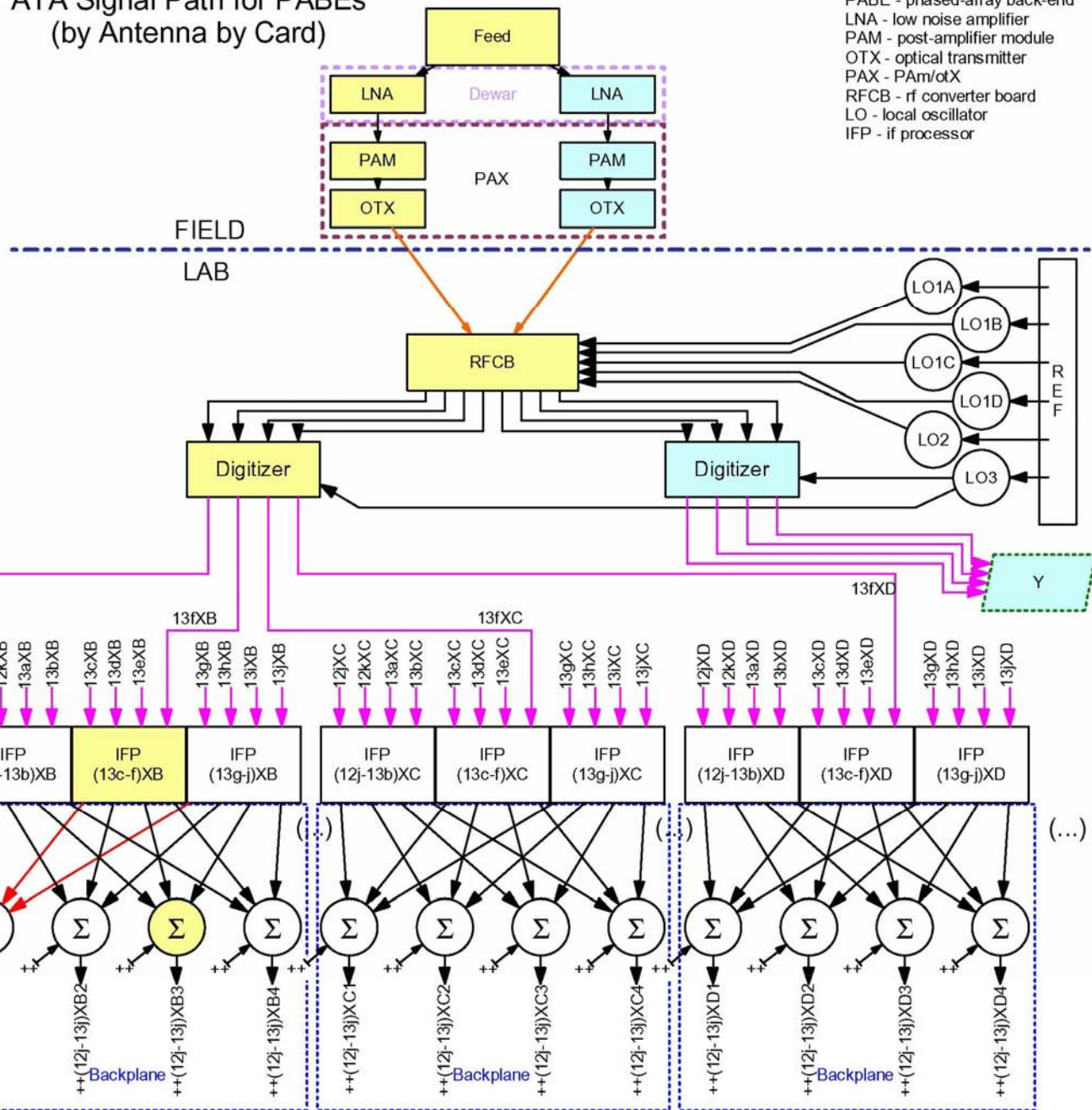
13 refers to the "zone"
 f refers to the "element" within that zone
 X refers to the "polarization"
 B refers to the "tuning"
 3 refers to the "delay set", which defines the phasing of a resulting beam

13f refers to an "antenna"
 13fX refers to a stream on "analog fiber"
 XB3 refers to a "beam" (implying all antennas, subarrays would be listed)
 13*X refers to the X-pol fibers from node 13

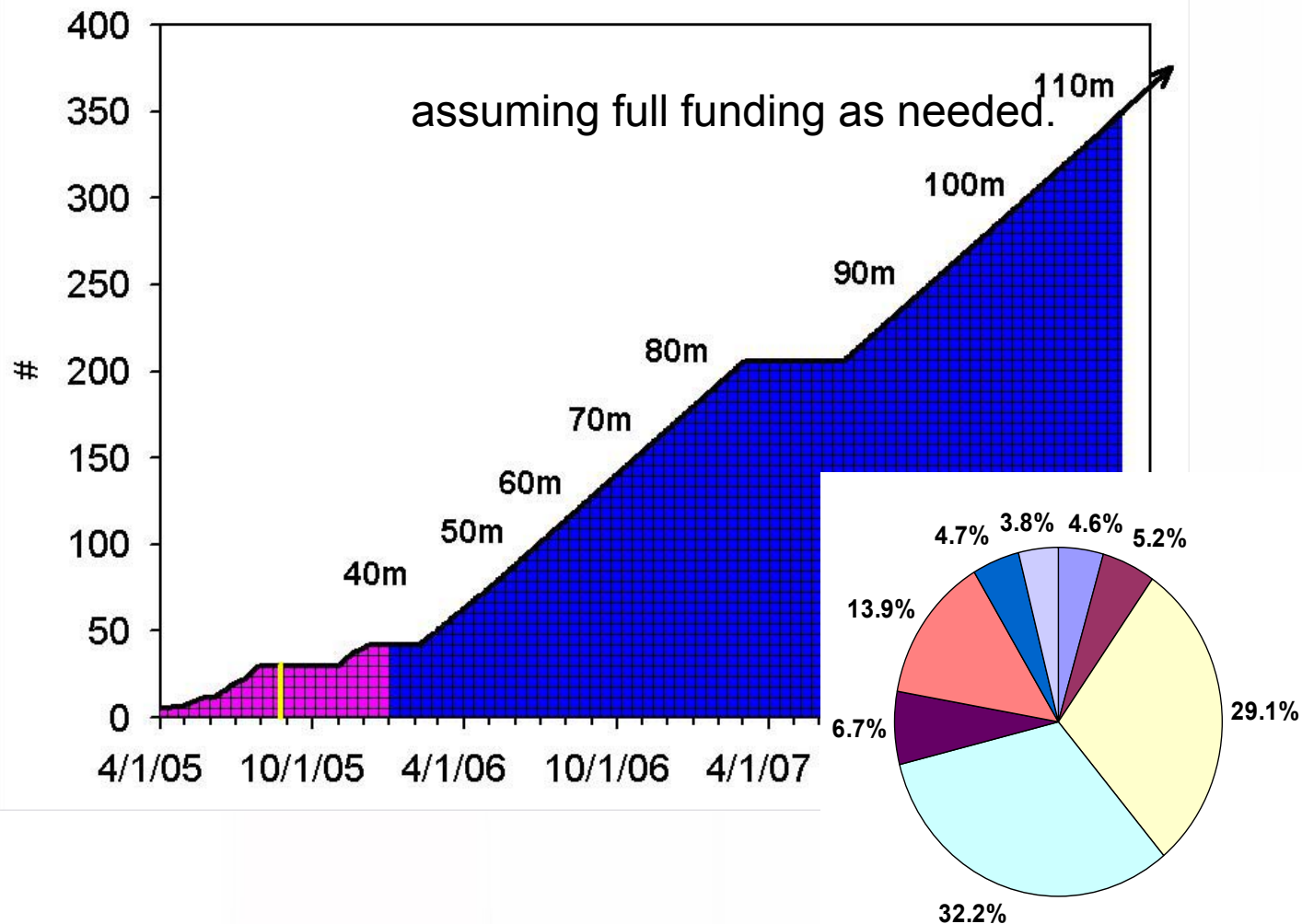
Each box represents a card.

Highlighted cards trace the example stream

ATA Signal Path for PABEs (by Antenna by Card)



Schedule



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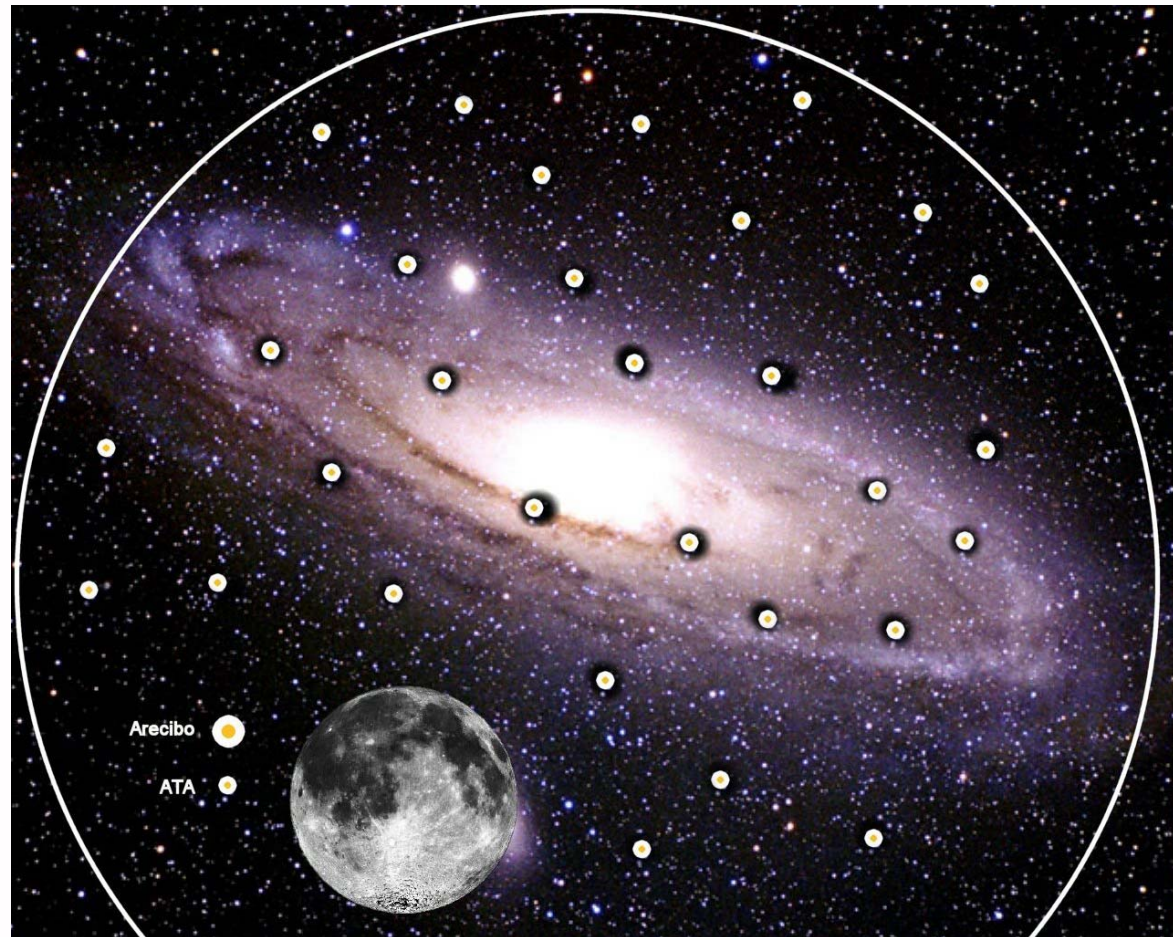


Array



Flexibility

**Beam former
generates
16 dual-pol
pencil beams
anywhere
in the sky
(100 MHz)**



Array



Telescope

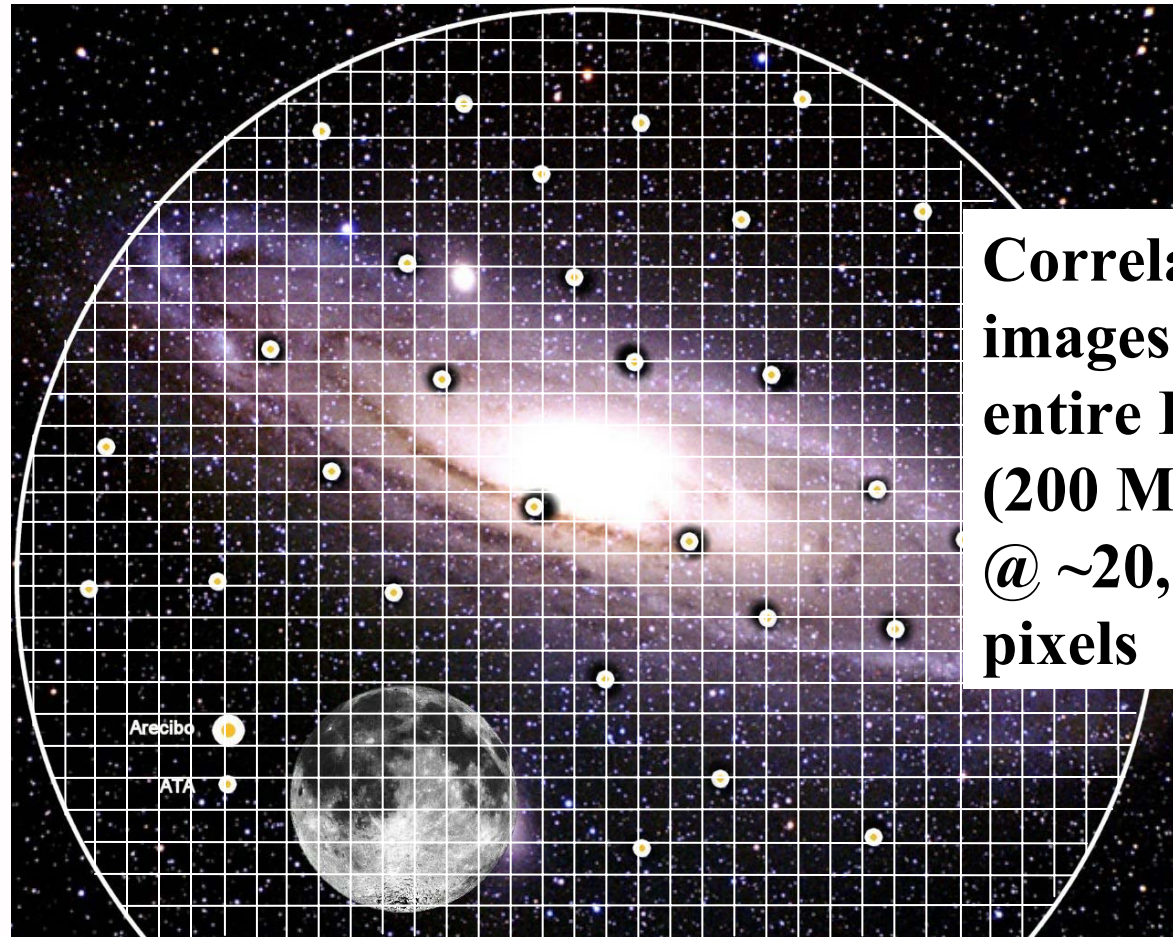


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Flexibility

**Beam former
generates
16 dual-pol
pencil beams
anywhere
in the sky
(100 MHz)**

**Correlator
images the
entire FoV
(200 MHz)
@ ~20,000
pixels**



Array



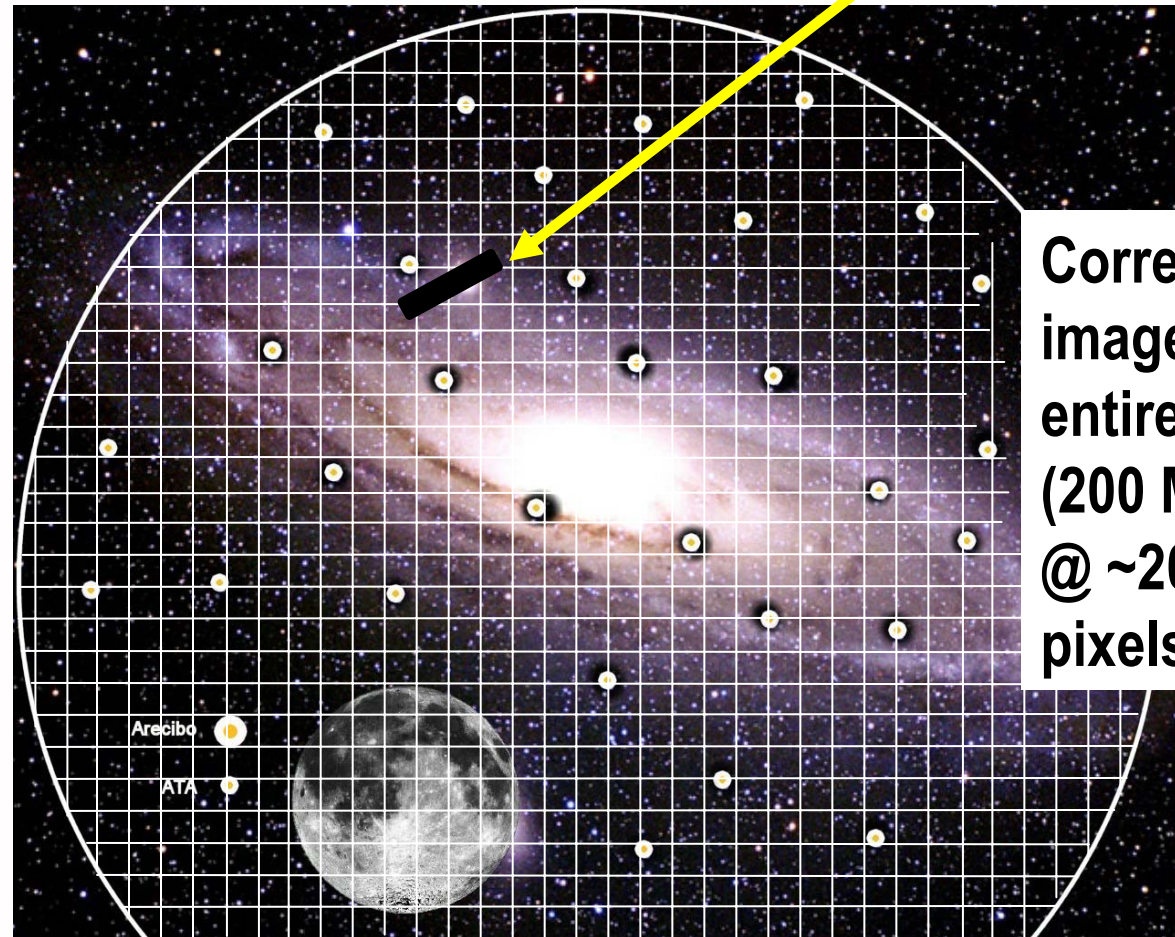
Telescope

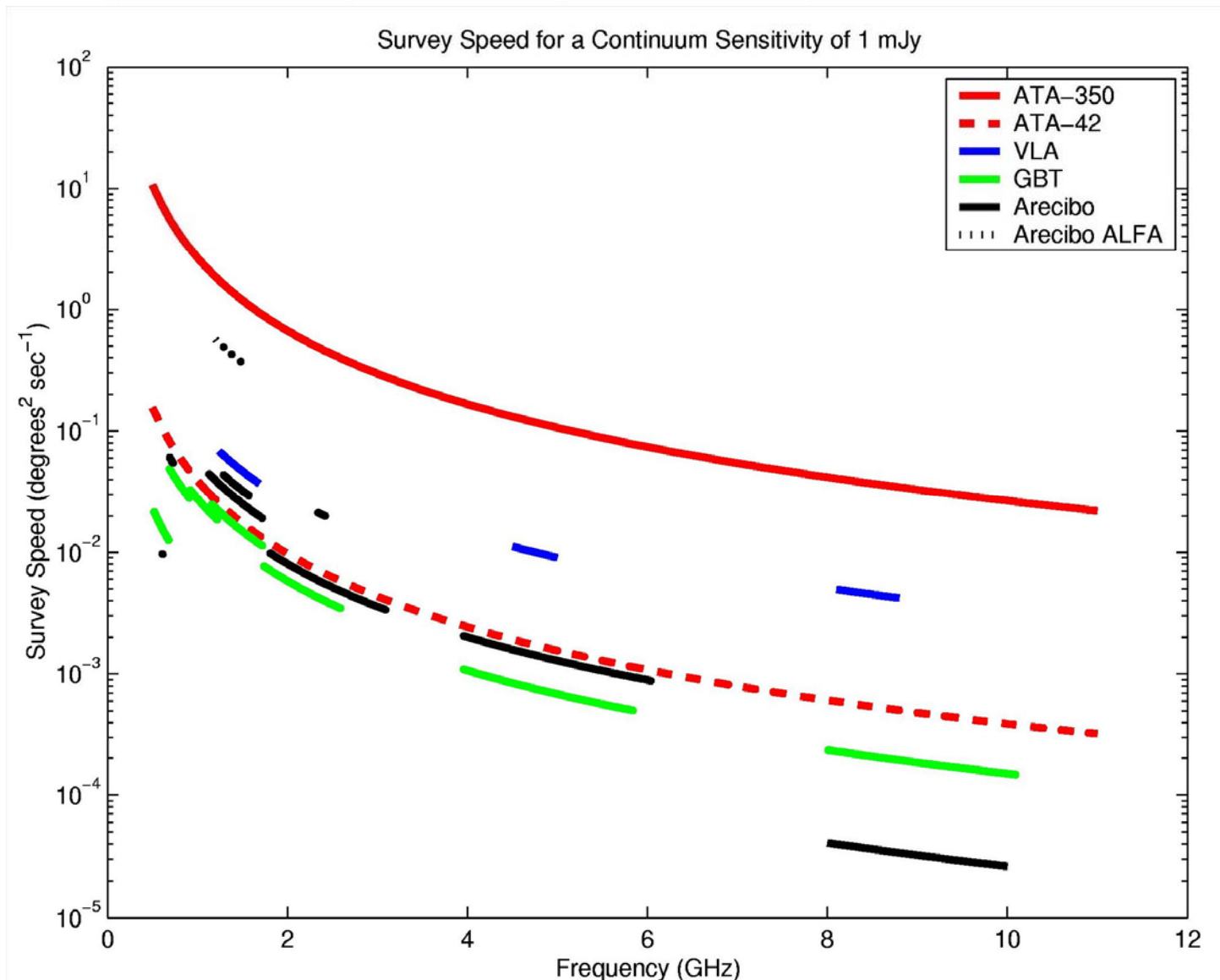


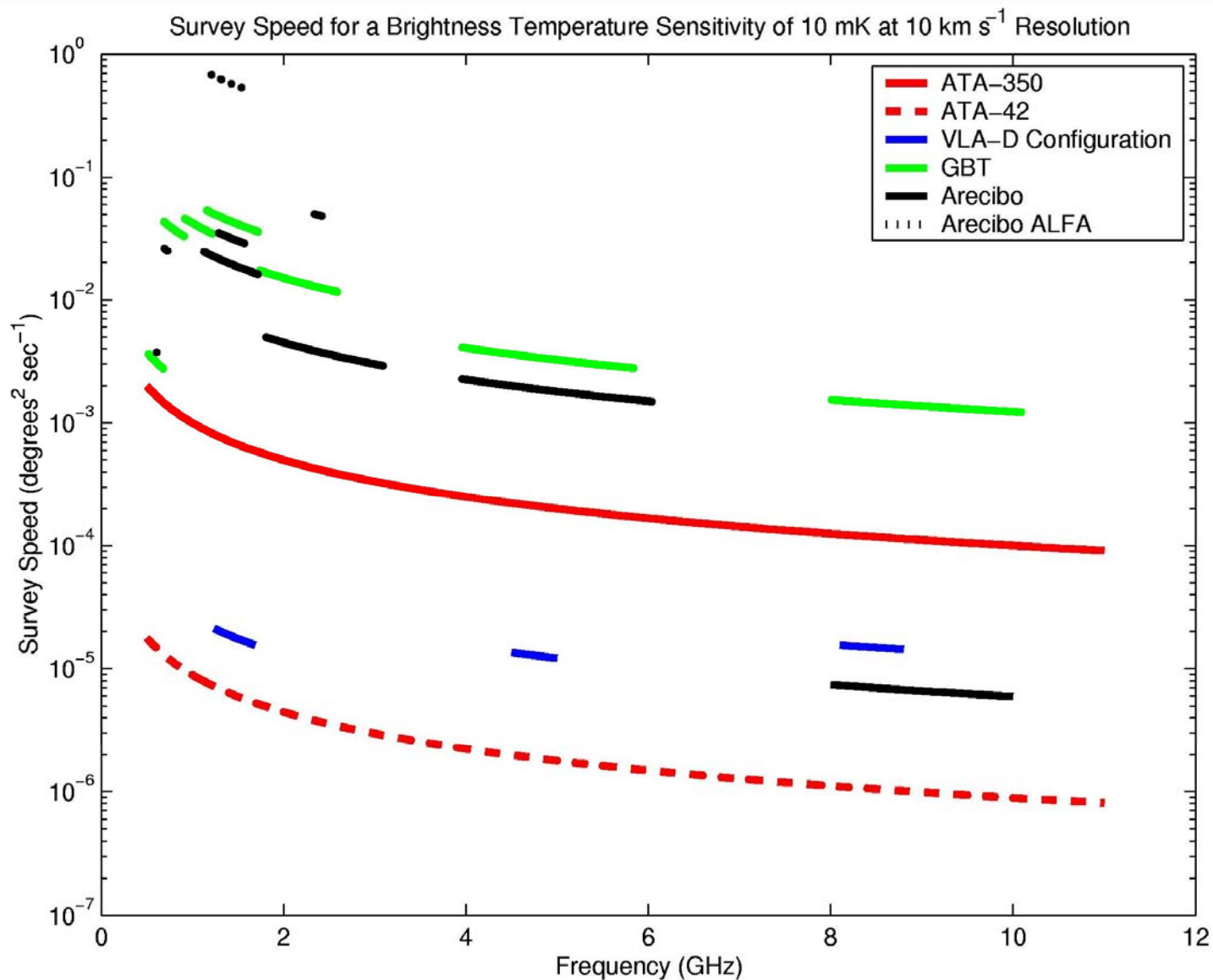
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Flexibility

**Beam former
generates
16 dual-pol
pencil beams
anywhere
in the sky
(100 MHz)**







Survey Speed to Detect M31 in HI Emission As a Function of Galaxy Redshift

