The One HectareTelescope

Progress Report for SKA Workshop at Jodrell Bank

John Dreher
Project Scientist
Acting Project Manager

August 3, 2000

The Allen Telescope Array

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- Large, massively parallel array of “TV” dishes
  - ***500 elements*** each 5 m in diameter
  - total collecting area ***larger than 100 m dish***
  - 0.5 - 11 GHz ***simultaneously***
  - ***multiple*** beams

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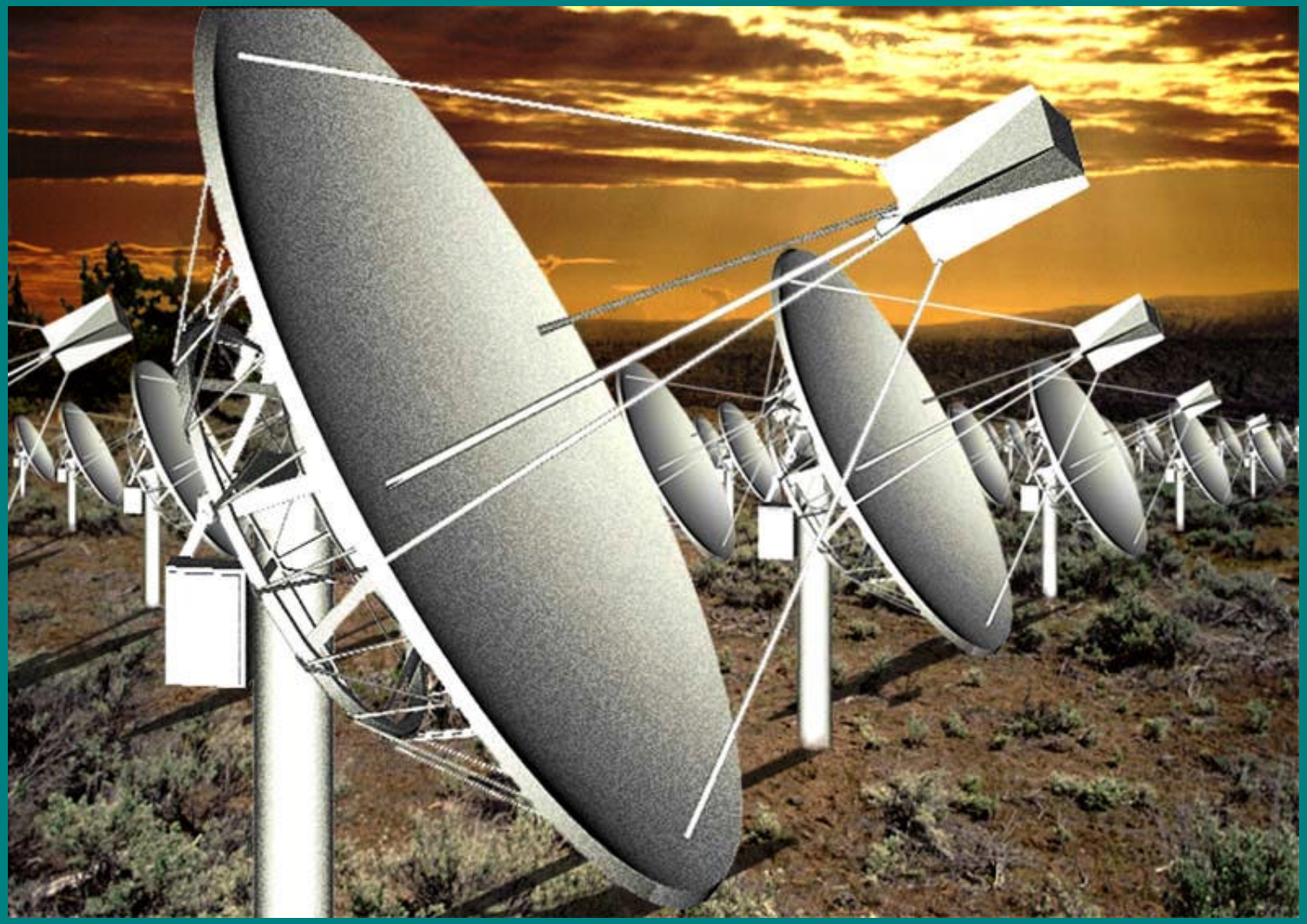
- 26+ M$ from Allen, Myhrvold, others

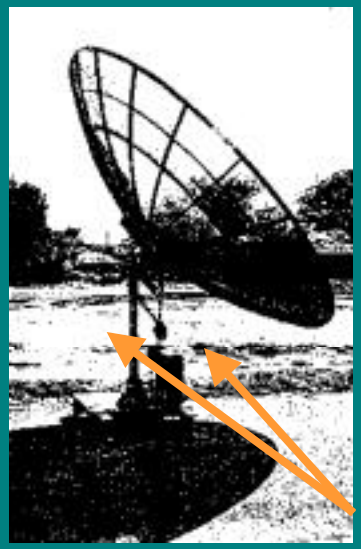
The ATA at Hat Creek



Mounts

5 m Prototype

belt drive az-el



3.6 m Orbitron

XY drive

Dual Linear Actuators

4.2 m Andersen

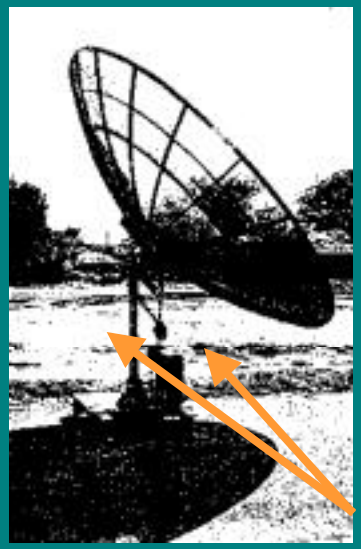
worm gear az-el

Mounts

5 m Prototype

belt drive az-el

undergoing torque tests



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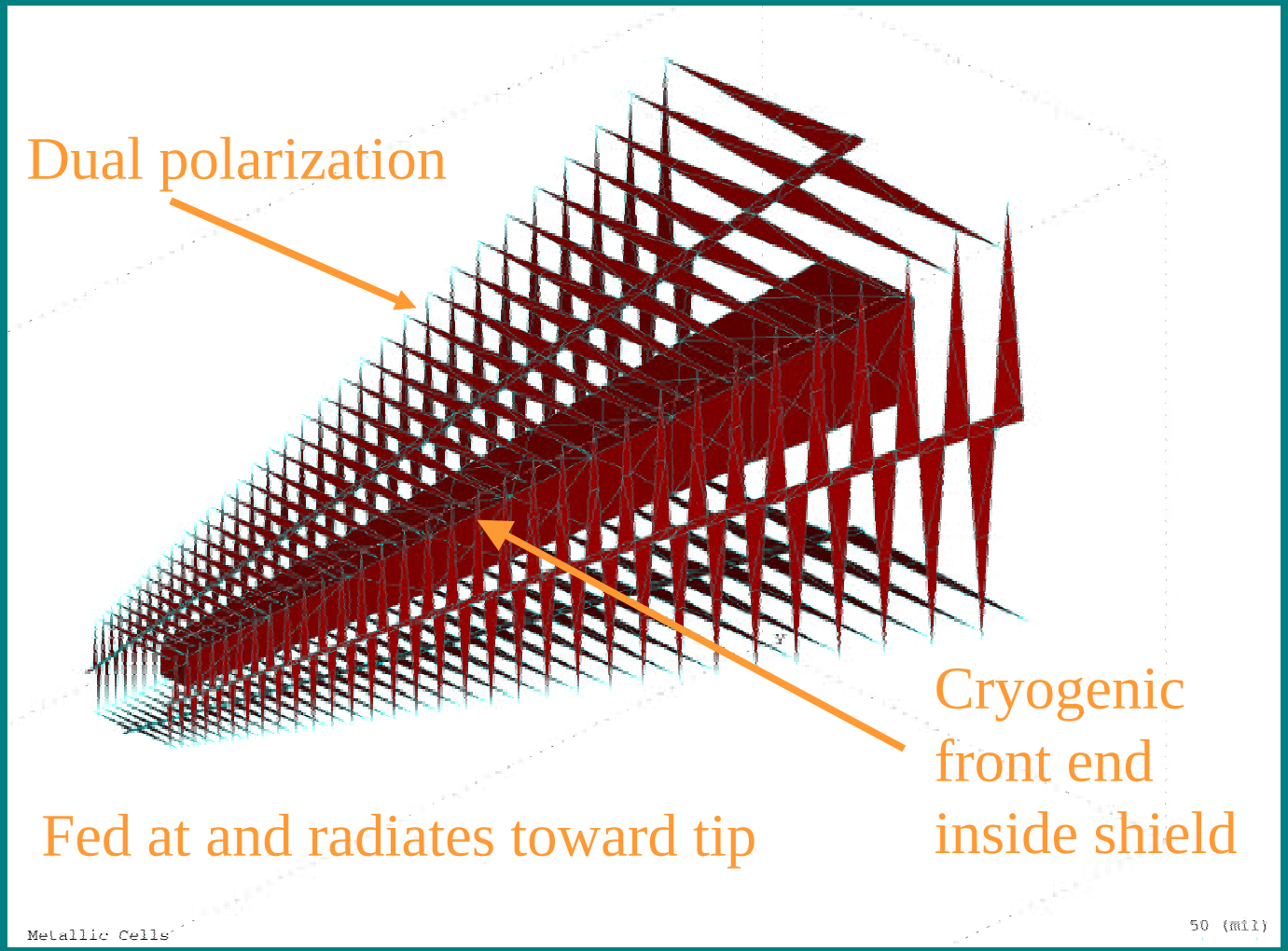
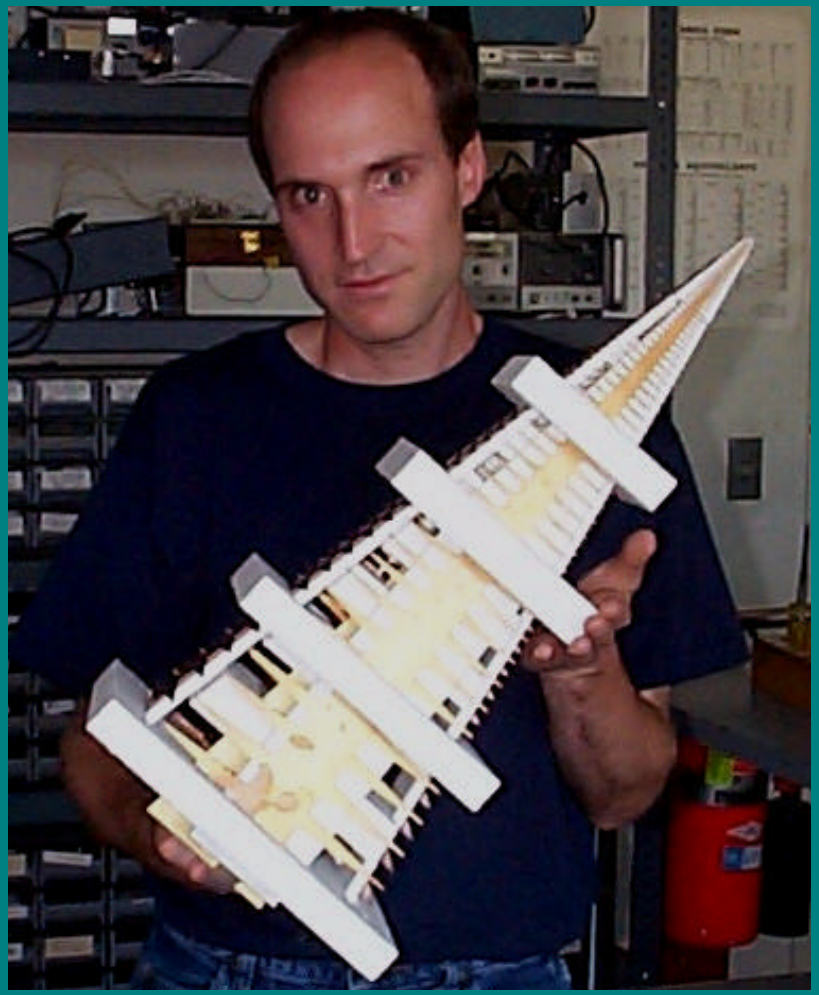
Ultrawideband Log Periodic Feed

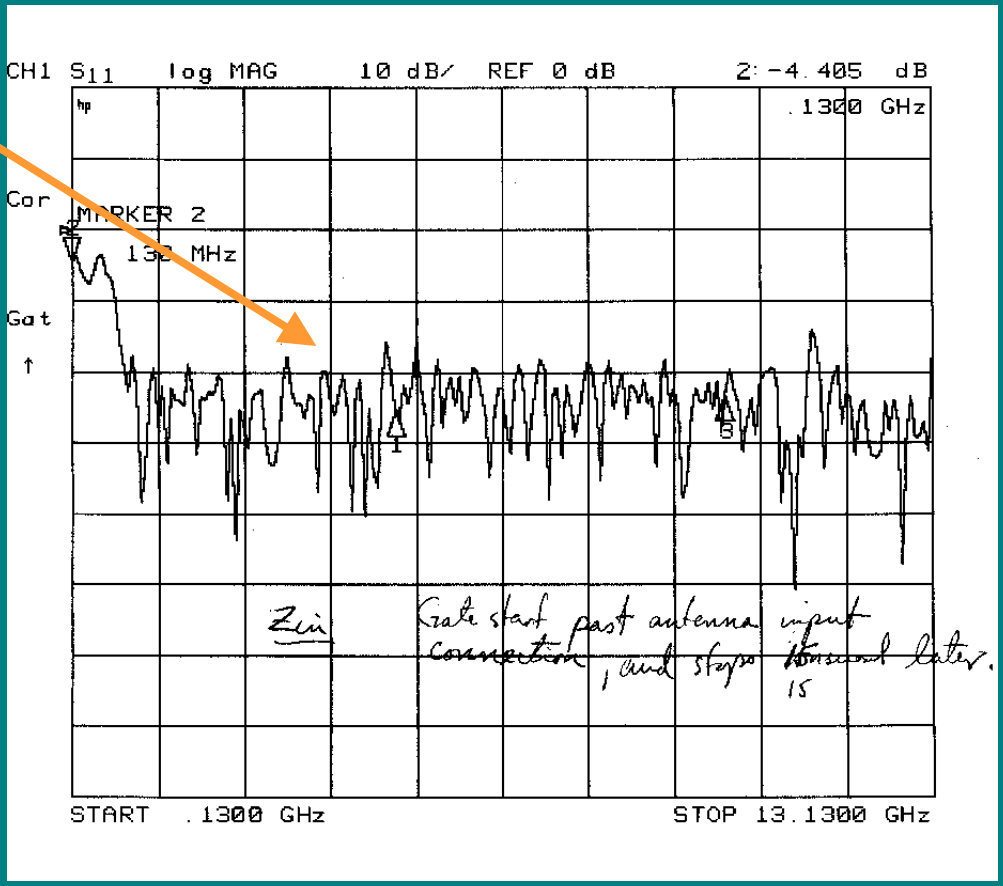


Prototype Feed for Tests



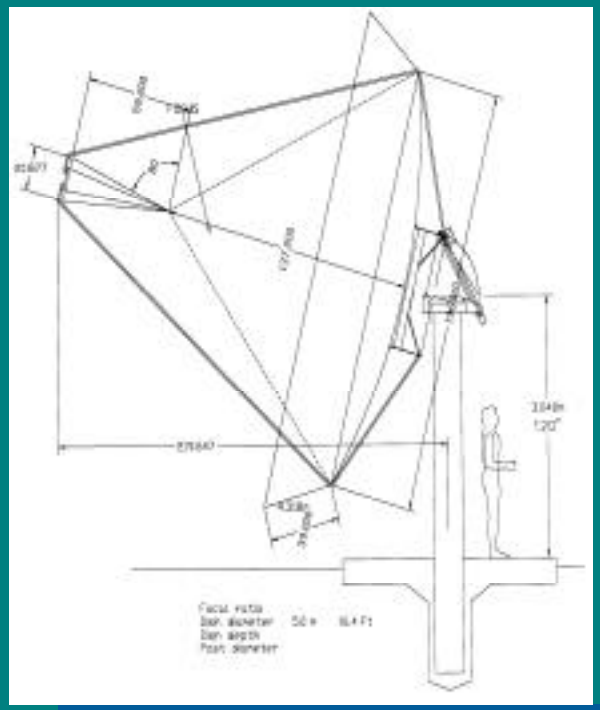
Preliminary Feed Tests

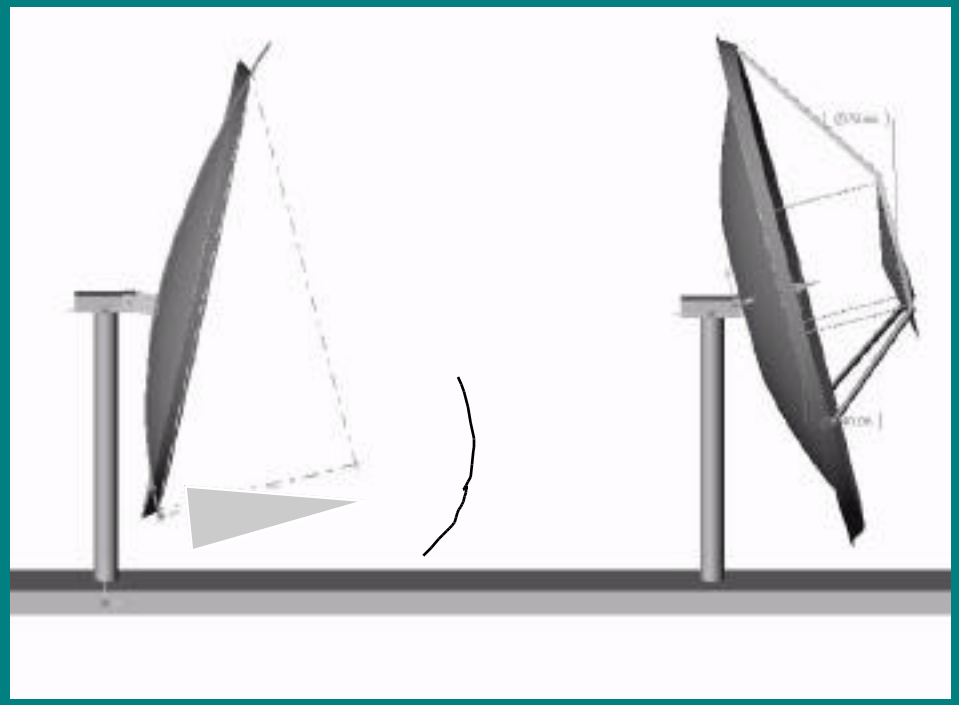
- Excellent (20 dB) match
- Agrees with EM calcs on
  - Impedance
  - Gain
  - Internal Loss
- More tests ongoing

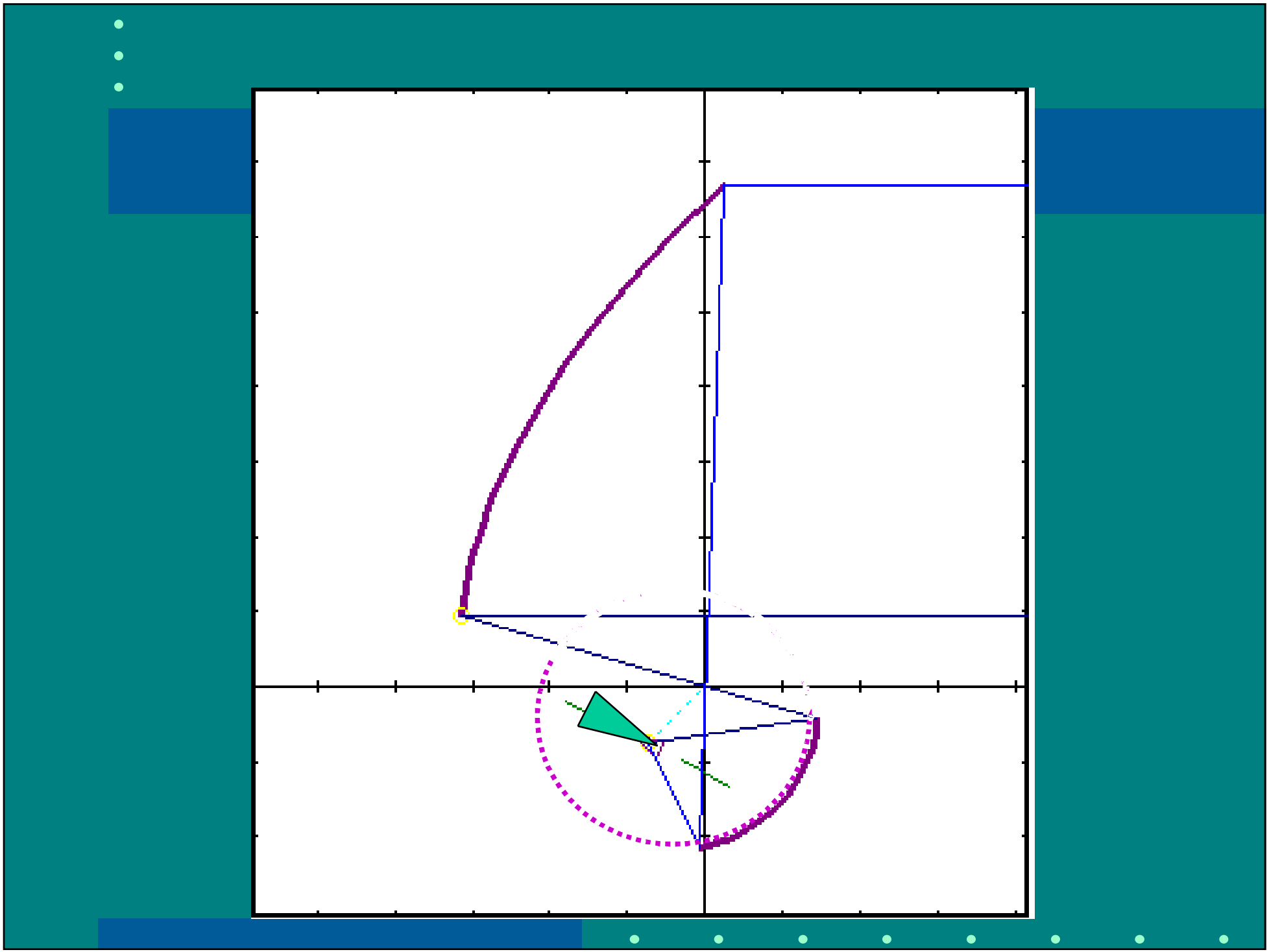


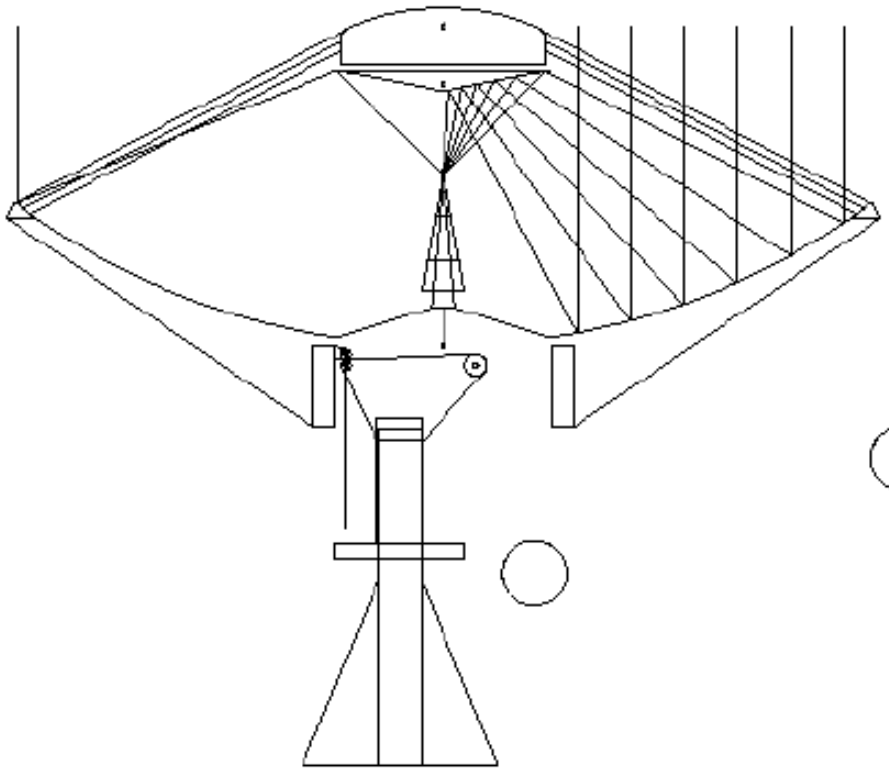
Optical Design in progress

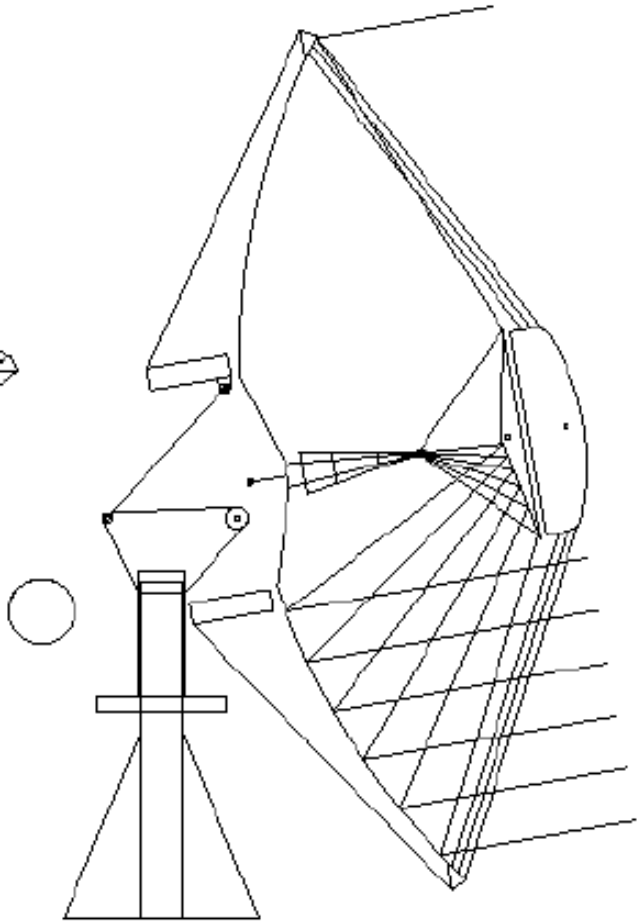
- Prime focus with spillover control skirt
- 6 m symmetric shaped Cassegrain
- 5 m offset Gregorian











Prototype InP MMIC LNA

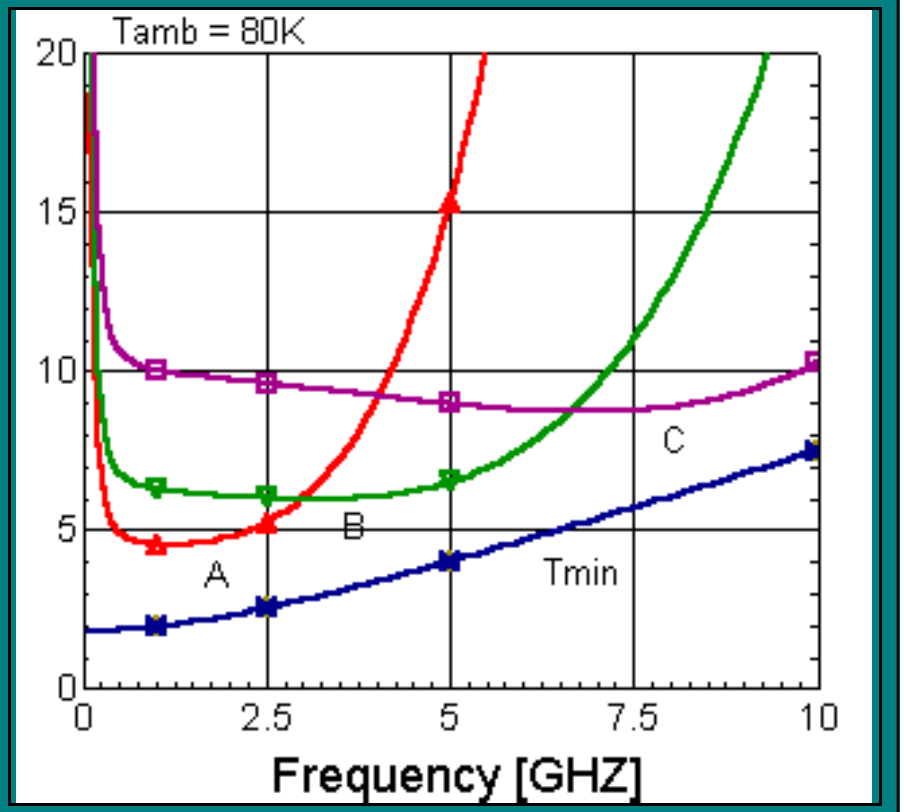
MMIC

In-P PHEMT

0.18 microns

Weinreb

model T_{sys} ~ 10 K



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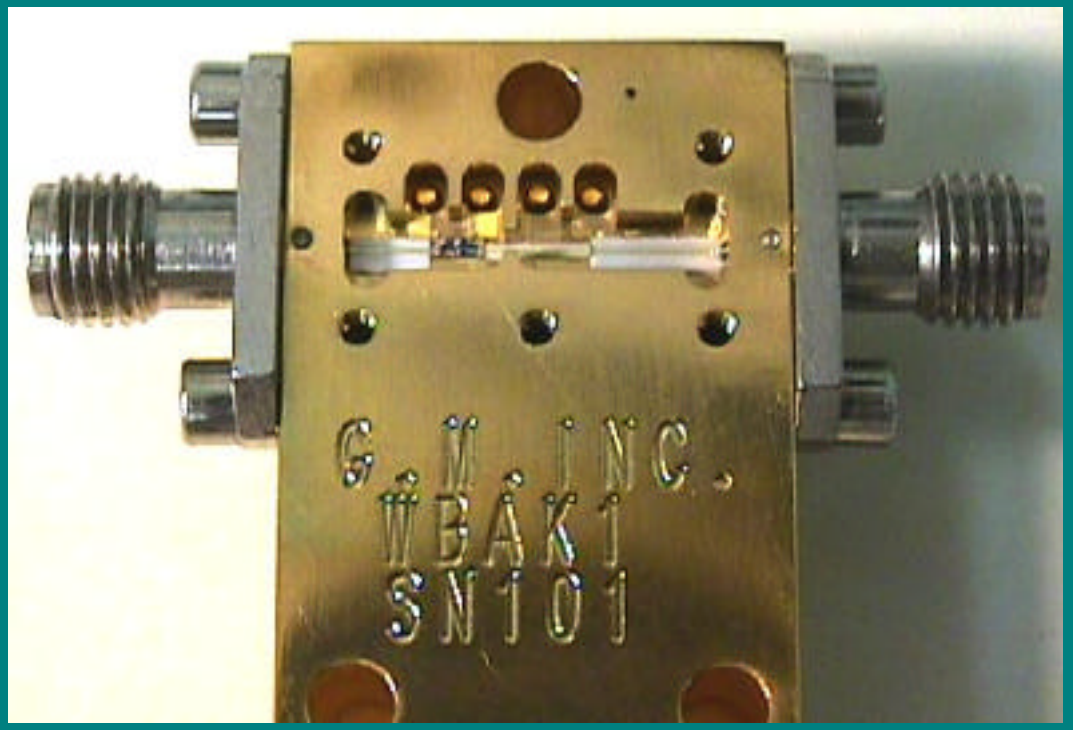
Model T_{in} ~ 10 K

First try
- works fine
- T_{in} ~ 20 K



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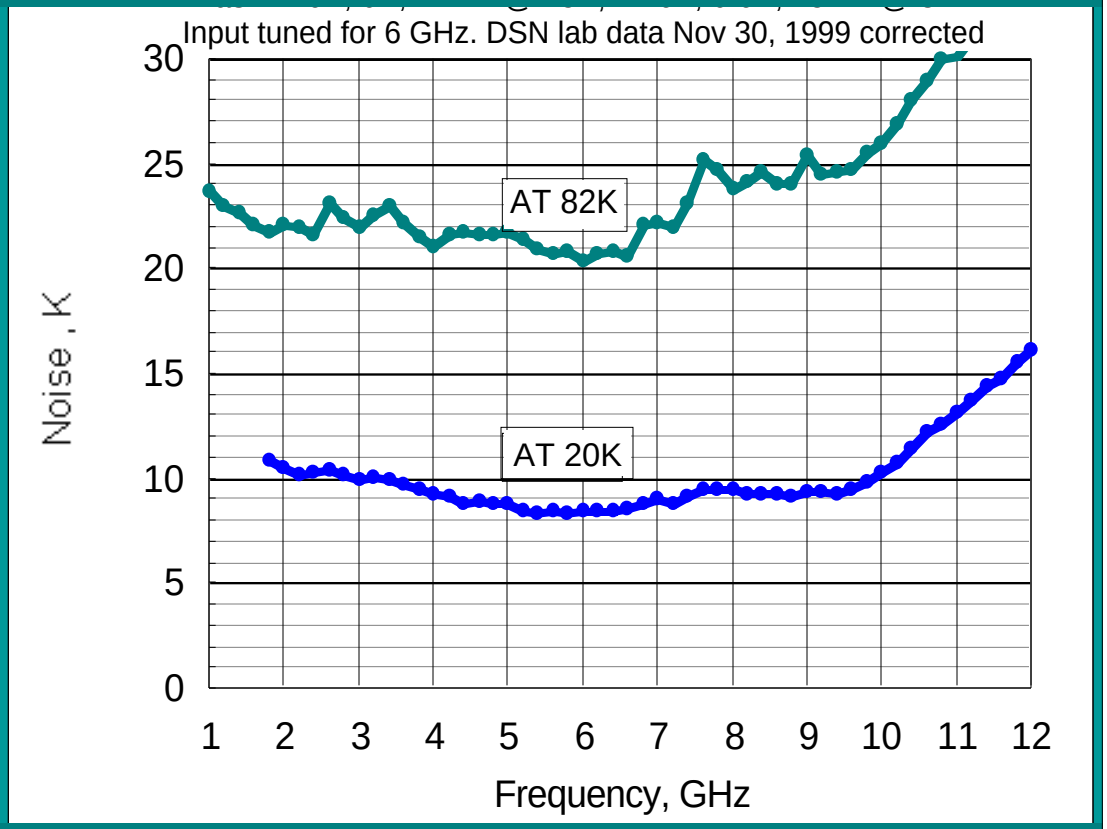

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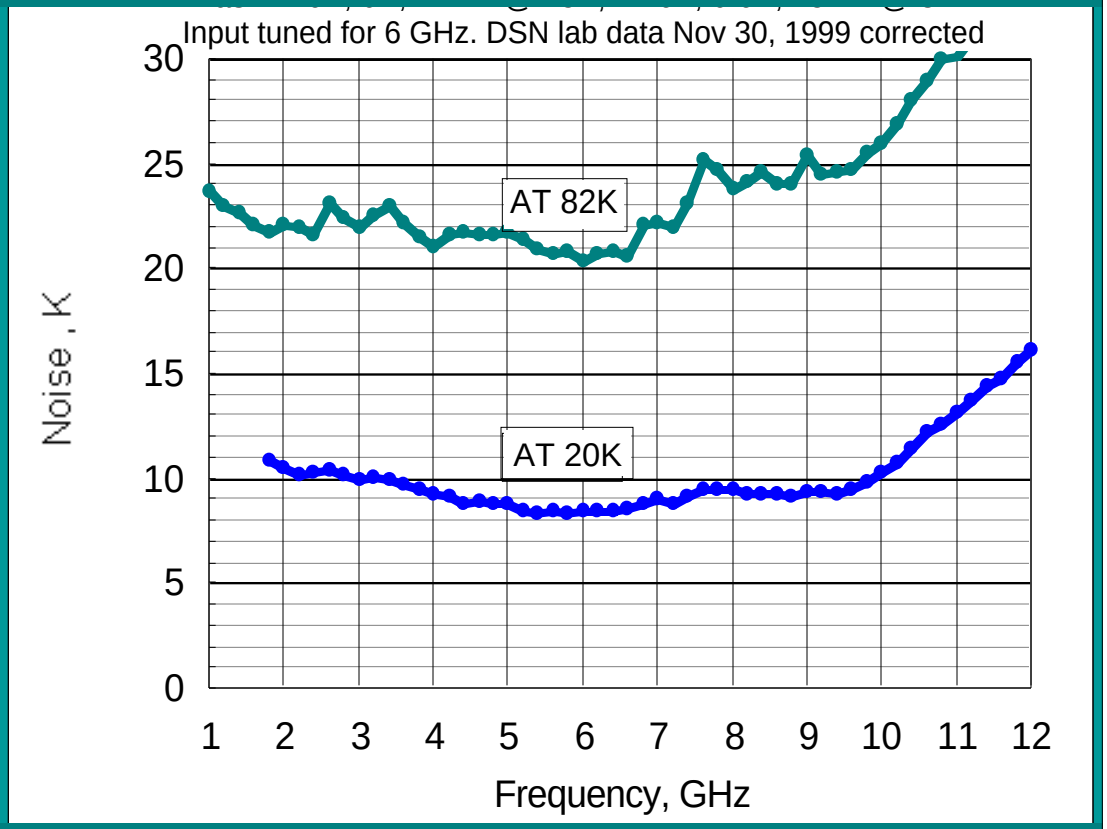


Third revision (with active balun) in fabrication

80 K Cryogenics

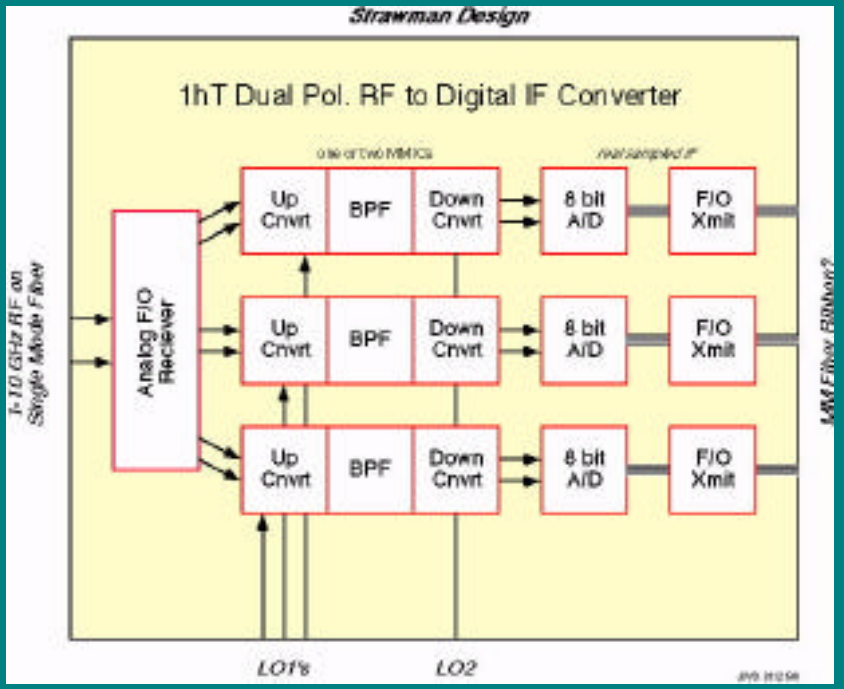
- Must be
  - Small (to fit inside shield)
  - Reliable (> 10 yr MTBF)
  - Cheap (< few K$)
- In-house solution
  - “vacuum tube” style dewar with getter
  - Pulse tube cooler (no moving parts)
  - Clearance seal compressor with voice coil motor
- Commercial solution also possible

0.5-11 GHz Analog F/O Links

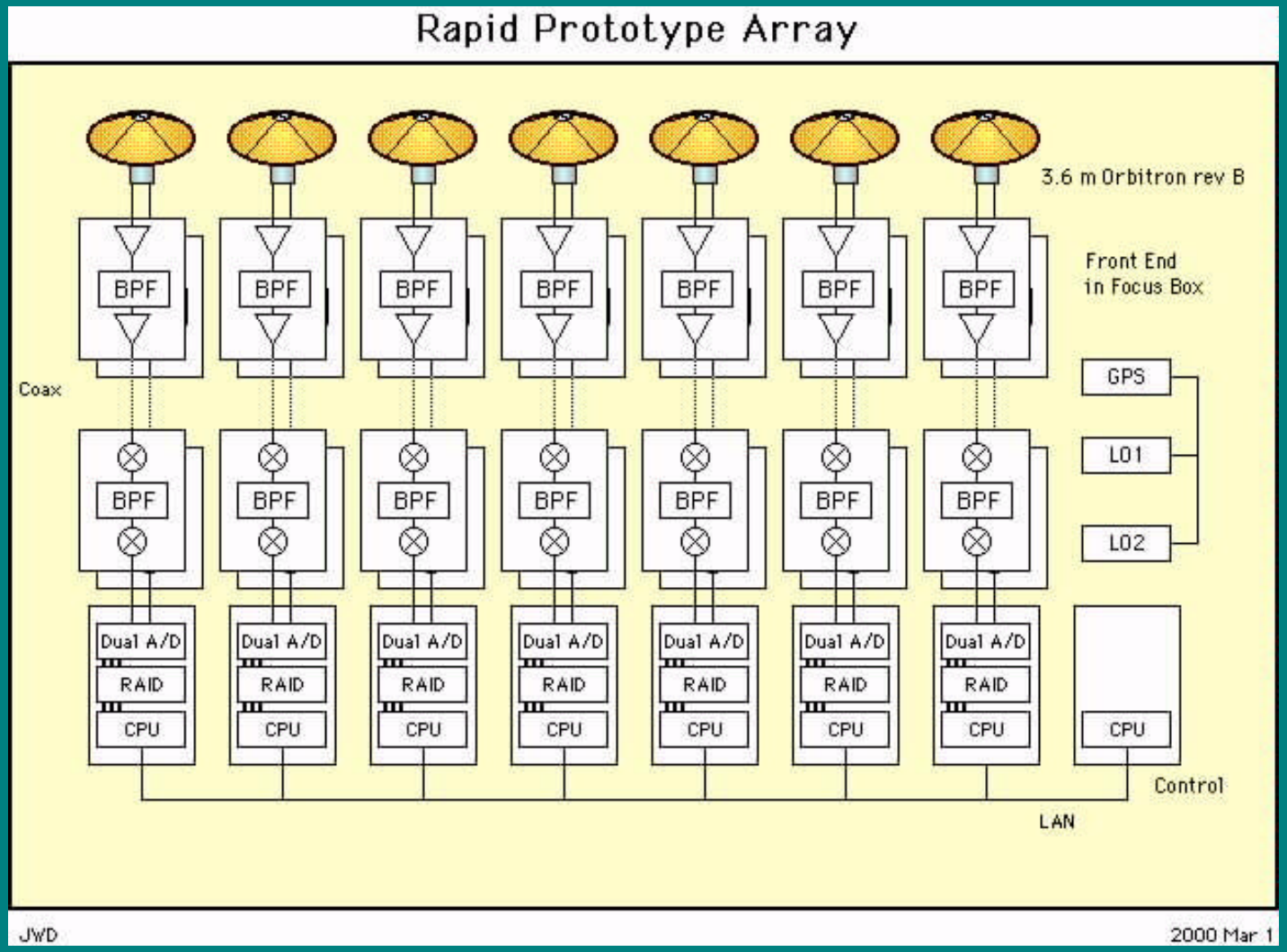
- Off the shelf units too expensive now
- Reduced component costs soon due to recent massive investments by industry
- Laser progress “Real Soon Now”
  - Cheaper DFB, e.g. Ortel “Daytona”
  - 1300 nm VCSEL (Gore, Novalux, Cielo, Agilent, Infineon)
  - Cheaper solid-state lasers?
- External modulators with common laser?

Signal Processing

- Up/down converter
  - PsHEMT GaAs MMIC(s)
  - Development at NFRA
  - 1st mixer block in fab
- DSP architecture TBD
  - Beamfomers (>3 beams)
  - Digital delay and IF
- Cross correlator with BW set by cost
- RFI mitigation and removal designed in



Rapid Prototyping Array



Timeline for ATA

1999-2000

- R&D Phase
- Rapid Prototype Array of 7 antennas built
  - calibration, beam forming, RFI excision, telescope control
- Selected site, began approval processes
- PDRs : most done by year's end
- Design staffing nearly complete

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Wanted: DSP Wizard!

Timeline for ATA

2001-2002

- CDR
- Build Production Test Array
- Operational tests begin
- Develop tools

Timeline for ATA

2003-2004

- Begin construction
- First use of partial array

2005

- Array complete - extensions begin
- Feed into SKA technology decision point